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VOLUME XXXII NO. 3

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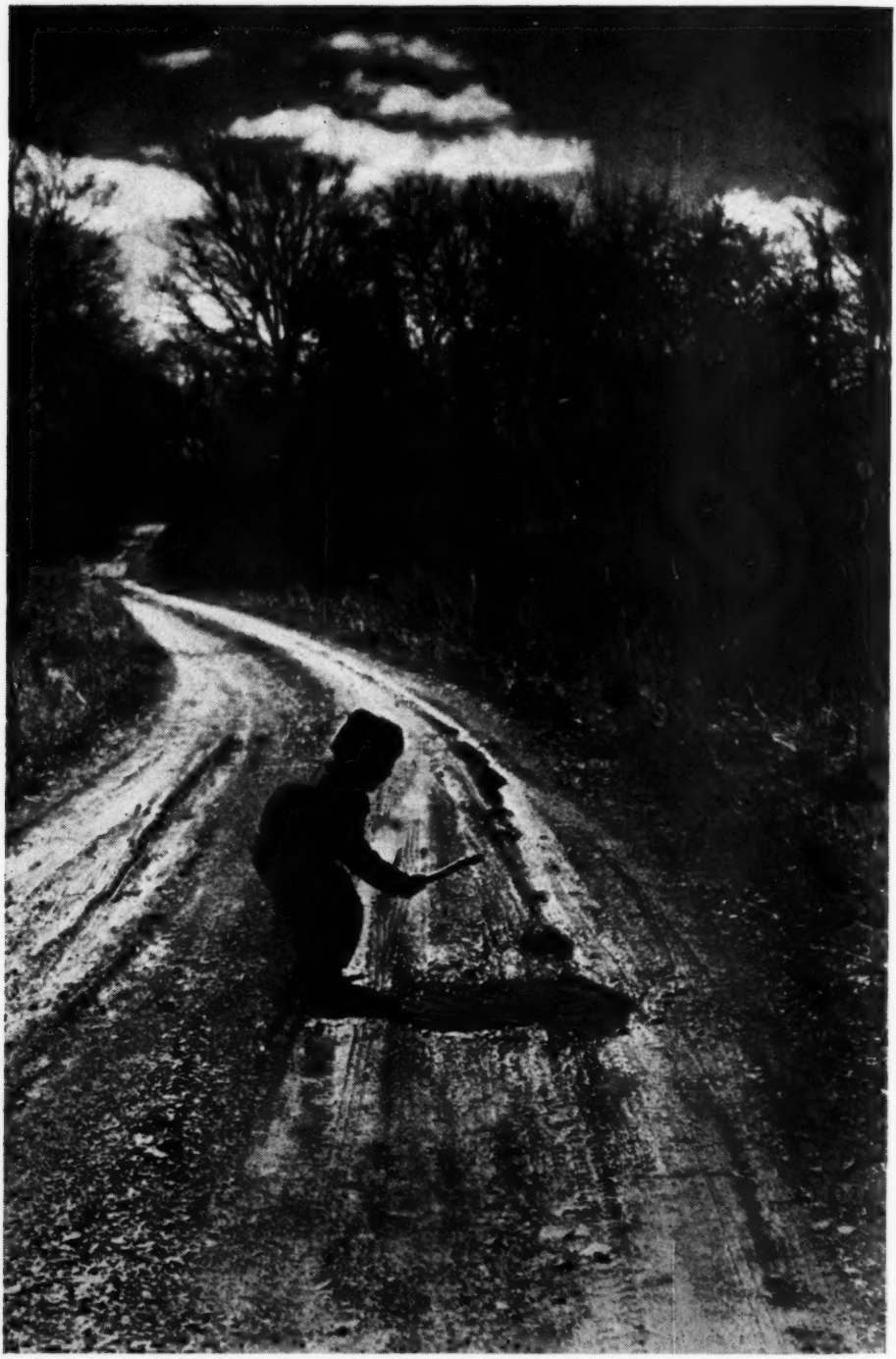

Courtesy WJZ Farm News Program

A GOOD MUD PUDDLE—ONE OF THE FIRST SIGNS OF SPRING

Better Crops with PLANT FOOD

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Vol. XXXII WASHINGTON, D. C., MARCH 1948 No. 3

For country and self . . .

Weed 'Em for Freedom

Jeff McDermid

THIS piece is intended to inculcate zest for growing esculent herbs in the confines of a dog-tight and hen-proof garden, tended by readers addicted to brilliant brochures, bug powder, and hand-hoeing husbandry. However, allow me to put in a preface 'ere we buckle down to the beets and the broccoli.

If you and I truly represent Mister Per Capita, that old, musty, statistical nonentity so often used to befuddle things, then we'll each be presumed to gobble up eight times our liveweight in food, or about 1,300 pounds' worth during 1948.

That's the gospel according to the seers and wiseacres in the Bureau of Agricultural Economics, who divide this sizable lump of eatables apiece something like this: (figuring that as long as the stuff disappeared from the surplus pile, it obviously must have gone down our alimentary canals)—fluid milk and cream, 386 pounds per person; fresh vegetables, 257 pounds; wheat flour, 146 pounds; fresh fruits, 143 pounds; meats, 148 pounds; sugar, 100 pounds; eggs, about 46 pounds; chicken, 23 pounds; and all manner of fats and oils, 41 pounds.

Carrying it back a bit, the same cogent authorities aver that in any of the years between 1935 and 1940 each of us recessed from toil long enough to absorb about 1,175 pounds each, regardless of warnings by doctors and bankers. Hence these records (which I can't challenge or refute) indicate that we will swallow 130 pounds more victuals

in this year of world food shortage than we did while raiding the larder before hostilities began.

Now to get down to my real story. This extra hunk of nutrition we'll inhale in 1948, which equals the weight of a good fast endman on a high-school football team, is going to shear our shekels to the tune of about two dollars for every iron-man we laid across the counter at prewar food prices. This simply proves that our appetite does not, as Bill Shakespeare claimed, stay geared to our digestion, but wanders at will with the size of our incomes.

In other words, we too often eat up all the profits. The high cost of living can be located right behind the belly-button without recourse to X-rays, instead of behind the counter, as so many irate housewives maintain. Moreover, looking hard at the 1948 food intake barometer, we note that fresh vegetables make the heaviest item but one in the whole list. Fortunately, it is also the easiest to eke out by a little backyard calisthenics.

NOW I've arrived at the point where I can begin to talk like a lot of high-toned garden specialists launching a booster campaign at Hotel Statler, to which I hasten to add I was not invited as either a collaborator or a critic. This modern super-duper organization fever is probably absolutely necessary owing to the terrific crossfire of ammunition of every caliber and velocity of which the air is full of nothing else but. Yet I cannot refrain from recalling the days bygone and bucolic when townfolks staked out cabbage patches and potato plots devoid of any manifestoes emanating from great centers of culture and learning.

Homeopathic and home-grown remedies derived from particular plants urged the ambitions of listless spring-fever victims into unusual ardor when I was a lazy lad. Onions helped stop colds—and everything else within breathing distance. The green shoots of asparagus possessed diuretic virtues. Pinkish-red stalks of burgeoning rhubarb, set deep in nail-kegs, grew tall and tender and proved superior to Doc Jolter's laxative. Bumper crops of gargantuan tomatoes provided us with a tasty spring and summer tonic far nicer to regulate us inwardly than the concoctions that the country doctor doled out to us from his caseful of labeled vials.

TO be sure, we knew nothing of thiamine, riboflavin, and ascorbic acid; but we knew how to recognize and pronounce the vegetable essences which somehow boiled and bubbled in our systems and coursed through our veins with such benign and restorative blessings.

Moreover, aside from the kitchen gardens of our own and our relatives' providing, there were then few groceries that could be relied upon to display tempting green goods to whet the appetite and ward off the doctor. This also means that there were no long-distance refrigerator facilities to tote us seasonal and pre-seasonal tidbits from distant climes.

Right at this point the modern garden boomers cut across lots to avoid some harsh criticism from the far-flung web of modern commercial vegetable growers and handlers. It is said that sometimes the professionals dislike to have too many green thumbs invading the fields of Pomona. We need not be so apologetic. Thousands of country-bred people living in cities have no space for gardens, and countless more cannot raise all they desire of certain truck varieties that need much room. Truck growers fare much better in a land where customers know quality through personal experience than where nobody ever thrust a spade into Mother Earth.

Back to bygones again, it was seldom that old-timers grew gorgeous gardens simply because they had to save money. Such a reason as that is ultramodern, belonging to these hectic and store-ridden days alone. Besides the satis-

faction inherent in hand-work well done, plus the medicinal and health-promoting attributes aforesaid, there existed a more natural and common rural tradition among the majority of American communities than we have left today. Most of our hamlets were peopled with retired farmers, who left the farm sooner than seems to be the case these days when machinery is ample and labor is scarce and children fewer.

Another argument, having no bearing on the number of gardens staked out in the Victorian era, exists today to bestir indolent ones to grab the hoe. I refer, of course, to the popular platform plea that the more grub we grow on this side of the pond, the easier it will be to provide grain and canned goods for the hungry foreigners. Even today, bad as things are abroad, I have grave doubts that many recruits will join the vegetable legion in my bailiwick imbued with "global" passions other than the onion and artichoke varieties. I would almost mistrust a guy who borrowed my rake for such reasons, knowing well that he would lose himself, my rake, and all his ambitions when the sun got hot.

World "politiks" and DDT may seem quite a lot alike in many ways, but I for one have reservations about overdoing the honest and natural fun of outdoor production with any far-fetched allegories or allusions. That doctrine might do for a feeble beginner, but it's not apt to withstand the dilemma of one who ponders whether to use rotenone or copper compound on a hill of beans besieged with Mexican beetles, or whether to rid his potato patch of wireworms with benzene hexachloride and stink up the kitchen, or let the bugs have the spuds in the first place. But when in making an appeal for gardening we reject all things of world significance there's something involved which we can't entirely forget, and it really puts an international stake in the midst of our onion beds.

YOU can tap off on the fingers of one hand the main vegetable crops grown in this country which are really native to it. The rest are immigrants just like ourselves. The principal original native Americans among the garden tribe are corn, potatoes, sweet potatoes, tomatoes, beans, and maybe squash. Just about all the rest of our basketful of garden luxuries are outright foreign-born species, albeit fully naturalized by this time. Plant explorers and breeders have made selections and hybridized galore, until what we now brag about and rely upon for "garden sass" represents American improvement upon the old migrating kinds, some of them harking back to primitive days before the Christian era.

So perhaps if we do finally contribute indirectly to the outbound shipment of relief foods by the conservation of our garden surplus in cans and driers, it would really be a gesture of appreciation for the garden seeds our ancestors developed and brought with them on their long voyages by clipper ships from the Old World, now plunged in misery.

And that would be no small item. In the latest estimates I've seen, gardeners for 1943 were credited with packing about four and one-half billion quarts of fresh fruits and vegetables at home. In the same season about 40 per cent of all the fresh vegetables consumed in this country were raised in Victory Gardens.

(*Turn to page* 49)

Peanut Land and What It Needs

By R. M. Marshall

Soil Conservation Service, Fort Worth, Texas

UNDER its virgin cover of grass or trees, our soils store up plant food. Past centuries full of plants which have come and gone have enriched the soil, giving it its inherent productivity. When man first sets foot on such land he is impressed by its bounty.

Indeed, he is on rich soil. The first crops set production records which seldom again are equaled in the locality. On the 14,000,000 acres of the Texas and Oklahoma Cross Timbers, for example, the all-time grain production records were set the first years after the land was cleared and broken out of the native sod. That has been less than a half century ago.

Such soils often can continue good and even excellent production for some time. The Cross Timbers kept yielding bumper crops of all sorts for 10 and 20 years after being put into cultivation. Year after year the land was tilled, crops were planted, and then they were harvested and removed. That was good, for the moment, for the landowner's pocketbook. But what was happening to the soil?

We all know. The soil began to lose its "life." That's another way of saying that the store of plant food in the soil was decreasing. Crops were taking plant food off and nothing was putting it back. Production decreased. Much of the Cross Timbers land finally was forced out of cultivation.

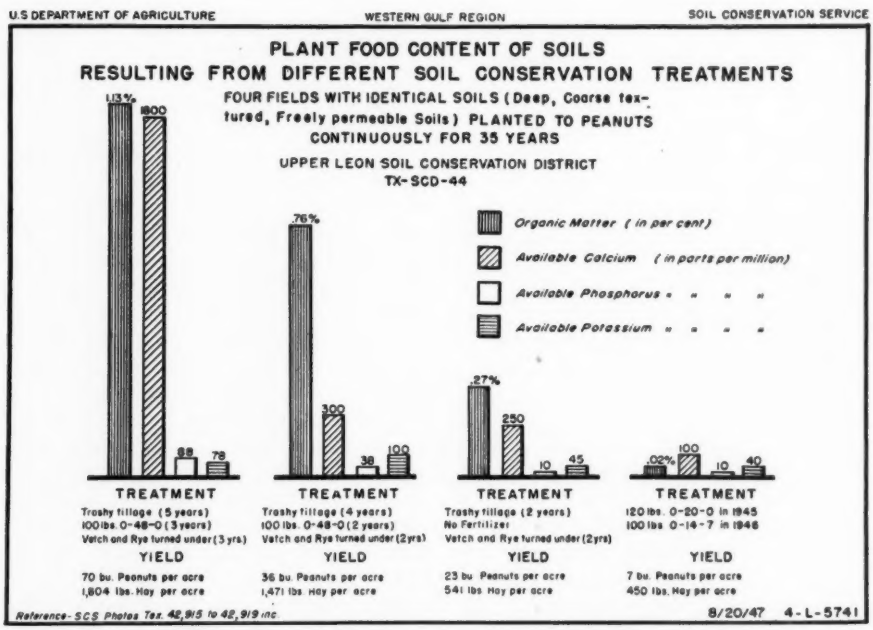
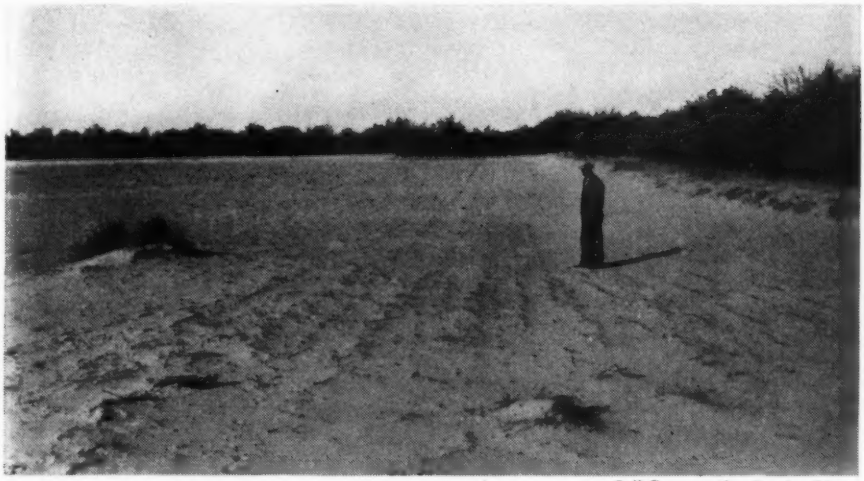


Fig. 1. Plant-food content of soils resulting from different soil conservation treatments.



Soil Conservation Service Photo

Fig. 2. Some soils of the Cross Timbers of Texas and Oklahoma blow easily when not handled properly. This Texas field, with much of the topsoil blown into the fence-row, grew peanuts in the summer, nothing in the winter.

Something to correct the situation was needed, but almost a generation passed before a solution arrived. That solution came in the form of farmer-organized soil conservation districts, first established in the late 1930s. The idea, since proved sound, for halting the plant-food removal called for a coordinated program of dovetailing soil conservation practices for each farm. These practices were designed to control the soil erosion and to improve the productivity of the land.

High on the list of the measures came a soil-improving conservation crop rotation. Such a rotation generally called for using a legume crop regularly on each field. Soil Conservation Service technicians helped farmers find out which legumes would work best. They came up with hairy vetch, Austrian winter peas, and several other soil-improving plants.

These crops aid in anchoring the fields against both wind and water erosion; they cover and tie down the soil. Regular crops do that to some extent in the summer, but it was not until the winter legumes were used that the job could be done in the off-season. Controlling the erosion was primary to making the soil of the Cross Timbers a permanent storehouse of food for growing crops to use.

Soils vary. Unlike soils won't respond the same way to identical use and treatment. Some light-colored soils of the Cross Timbers which are deep, loose, sandy, and inherently low in organic matter and available minerals absorb water rapidly. These soils do not wash easily. That's because they are able to take up water quickly and because the moisture penetrates deeply. But although not highly susceptible to water erosion, these same soils will blow easily under the winds which prevail most of the year. The topsoil either blows away completely or it accumulates in fence-rows and roadsides and fields where it isn't wanted.

Other soils are the reverse. They do not blow much, but they are easy marks for eroding water. Such soils in the Cross Timbers usually have medium-textured surfaces underlain by dense clays. They are moderately low in organic matter and available minerals, and they take water into the subsoil slowly, sometimes very slowly.

One of the major crops grown on the sandy lands of the nation is peanuts. Some lands have been planted to peanuts year after year without considera-

Soil Conservation Service Photo

Fig. 3. Peanuts collected from four different fields in the Cross Timbers where soils were about the same but treatments different. Each bundle contains 10 plants. The peanut bundles are lined up left to right in the same order as the fields whose treatment is described in the chart in Fig. 1.

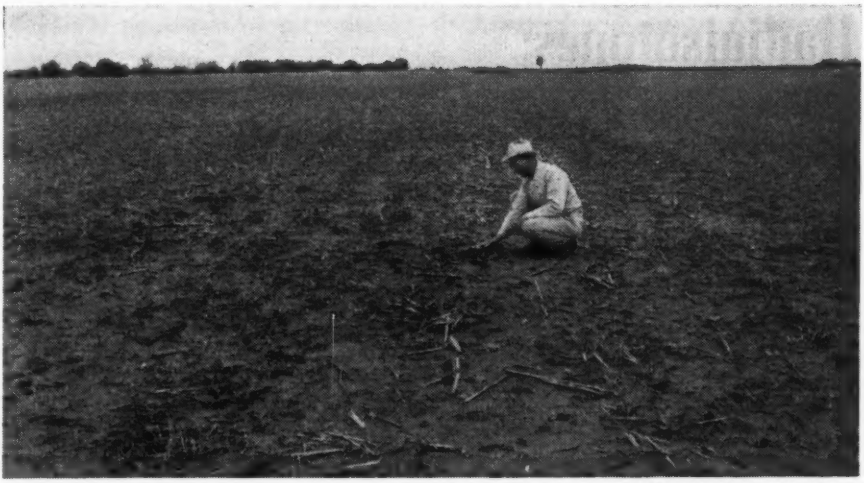
tion of the soil's erosion prospects or the maintenance and improvement of its productivity.

The H. H. Lawson farm in the Texas Cross Timbers has been growing peanuts for 35 years on deep, coarse-textured, freely permeable soil. It is good land, suitable for continuous cultivation when the right conservation practices are used to prevent soil-blowing and to keep productivity up.

Mr. Lawson early became a cooperator of the Upper Leon Soil Conservation District because his knowledge of his own place told him that conservation farming would keep his land permanently in production. The effects of his operations are vivid when contrasted

Soil Conservation Service Photo

Fig. 4. Abruzzi rye and hairy vetch used for winter cover, soil improvement, grazing, and seed production on a Cross Timbers farm near Rising Star, Texas.



Soil Conservation Service Photo

Fig. 5. Good management of crop residues. Cowpeas and combine maize stubble have been leveled with a stalk-cutter and a cover crop of rye has been harrowed into the surface of the soil. The trashy mulch left on the ground helps fight off wind erosion, gives the soil organic matter, and helps moisture penetrate.

with results where the soil-saving and improving measures are disregarded.

A case in point came to light recently when D. O. Davis, Soil Conservation Service technician, took samples of surface soils in four adjacent fields of the Upper Leon Soil Conservation District. The fields were of the same soil and all of them had been in peanuts for 35 years. In addition to the soil samples, Mr. Davis collected 10 peanut plants at random from each of the four fields.

The chart (Figure 1) tells the plant-food content of the soils in the four fields, the treatments that they have received, and the yields of peanuts and peanut hay per acre.

As the chart reveals, a combination of conservation practices was important in securing high yields and in maintaining a high level of fertility. One field where trashy tillage had been used five years, hairy vetch and rye plowed under for green manure three years, and 100 pounds of 0-48-0 fertilizer applied to the legume and rye crops showed the soil contained a great deal more organic matter, available calcium, phosphorus, and potassium than other fields which had received less conservation treatment. Yields were higher where conservation measures were most intensive.

Certain levels of plant food and organic matter content must be maintained in the soil if crop production is to be profitable. Experiments have shown the right amounts of fertilizers to use on most of the various soils. Limited data indicate that the plant-food levels for the part of the Cross Timbers near Rising Star and DeLeon, Texas, should be about 35 to 40 parts per million of phosphorus, 80 p.p.m. of potassium, and 750 p.p.m. of calcium, and an organic matter content of at least one per cent. Analyses will indicate for any given location the amounts of available plant-food elements. Knowledge of the correct level of productivity will show, naturally, needs for soil amendments or fertilizers.

Using a conservation cropping system which includes cover and soil improving crops properly fertilized, strip crops of grain sorghum or crotalaria, and proper management of crop residues are important in minimizing soil losses from wind erosion on these soils and

(*Turn to page* 48)

Radioisotopes:

An Indispensable Aid To Agricultural Research

*By Vincent Sauchelli**

Davison Chemical Corporation, Baltimore, Maryland

THE trick of producing "tagged" atoms—which the nuclear physicists call radioisotopes—gives the research scientist a powerful, new tool with which to probe into the secrets of Nature. By means of radioisotopes it is possible to trace the behavior of individual atoms in simple or complex chemical reactions in a way not possible heretofore. To understand this new tracer technique a brief review of the chemical and physical developments from which it stems will be helpful.

Years ago the English poet Blake sang of seeing a world in a grain of sand. Modern science has verified the poet's vision: the atom, the smallest unit of matter is, according to the latest theory, a veritable microcosm. The great Architect of the Universe followed the same sublime pattern of a constellation in fashioning the tiniest unit of matter. Just as in our own solar system the planets follow their majestic orbits around the solar core, so in the atom the electron satellites revolve round a nuclear core. Thus again, science verifies the unity of all Nature in a universe of law and order. How this new knowledge about the structure and behavior of the atom has developed and how it is influencing agricultural science will be briefly outlined in what follows.

Matter, the physical, tangible substance of the world, is something that from earliest times has puzzled the philosophic mind of man. What is it? How is it made? What is the ultimate unit? Hindu thinkers and Greek philosophers living before the birth of Christ conceived of matter as granular in structure. To the Greeks we owe the basic concept of the atom, but it remained for modern science to probe into, measure, and weigh the atom and transform speculation into chemico-physical science. The veil of mystery has been pushed aside and the knowledge of atomic structure ushers in a new power era of tremendous potentialities for good or ill, depending upon the moral stature of Man.

Compounds and Elements

Any explanation about atoms begins with the history of modern chemistry. All substances can be divided into two groups: the one, those substances which can be broken down by chemical means into two or more simpler substances, or can be synthesized by the chemical union of simpler substances. This group we call compounds. The other is the group comprising elements, which can neither be synthesized nor decomposed chemically. Examples: Common salt can be decomposed into sodium and chlorine; or, sodium and chlorine can be caused to combine chemically to form common salt. But sodium and chlorine are elements neither of which can be broken down chemically into any simpler material; nor can we take simple elements and chemically combine them to form either one. The

* Chairman, Fertilizer Industry Phosphate Research Committee.

chemist recognizes today the existence of a group of 94 of these, fundamental, simple elements.

Atoms and Molecules

The English chemist Dalton at the beginning of the 19th century formulated a theory regarding the constitution of matter. According to this theory an element consists of indivisible, invisible, identical particles which he called atoms, and he considered them the smallest piece of an element which can participate in a chemical reaction. Two or more of these chemical atoms can combine to form a molecule, which is the smallest piece of a substance that can exist.

The Atomic Theory

The atomic theory as Dalton conceived it has served chemists for many generations and has led to a better understanding of the chemical nature of things. Up until the close of the 19th century, it was generally agreed by scientists that an atom was indivisible. The word "atom" means that. Then came Henri Becquerel in France in 1896 with the discovery of radioactive substances, quickly followed by the researches of the Curies in France, and of Crookes, Rutherford, and other physicists in England which established the granular structure of the atom. Radium was discovered and with it the old concepts about the indestructibility of atoms gave way to present-day theories which are described in what follows.

The New Atom Model

If the old idea of an atom no longer held good, the question naturally asked was, what then are the ultimate and indivisible constituents of matter? The discovery of radioactivity gave physicists the chance to study atomic structure by probing right into the core of it, so to speak, and from those investigations developed today's theories and other concepts about nuclear physics. We return to the atom further along.

Electricity: Positive; Negative

At this point it is necessary to introduce an elementary discussion of electricity because such knowledge is essential to an understanding of the atomic theory of today.

As long ago as 600 B. C. a Greek by the name of Thales recorded that when amber was rubbed with a piece of wool it acquired the property of attracting small, light pieces of matter. The Greek word for amber is "electron." The property shown by the rubbed amber is also shown by a piece of sealing wax. This property has been called electricity. It might just as well have been called "ambericity" because it referred to the original observation of Thales.

If a glass rod is rubbed on silk the glass acquires the same property: it will attract a piece of dry paper or a pith ball. Most of us have at sometime or other made these tests. There is an important difference, which must be understood, between the electricity on the sealing wax and that on the glass rod. To show this, let us take two rods of sealing wax and one of glass and electrify each of them as explained. Let one of the sealing-wax rods be suspended so that it can move freely. If now we bring the glass rod near it, we see the suspended rod move toward it. Now let us bring the second sealing-wax rod close to the suspended rod; it is repelled. Thus the two sealing-wax rods which have been electrified by being rubbed against wool repel each other; while the glass rod electrified by being rubbed against silk attracts the other rod. Like repels like; unlike attracts. That is the important difference.

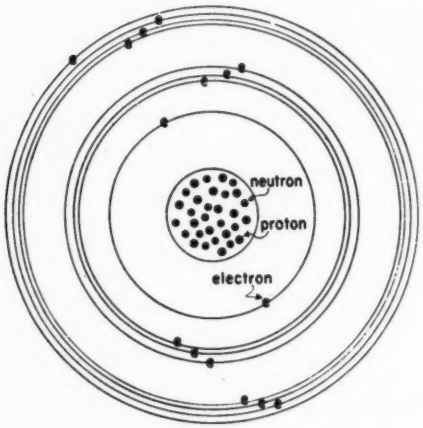
To distinguish the two kinds of electricity, since they are two different kinds, the name "positive electricity" was given to the kind displayed by the sealing-wax rod; and the opposite kind, as illustrated by the glass rod, was called "negative." For abbreviation the algebraic signs (+) and (—) were

given to the two concepts, respectively. This was done for convenience, only, the signs having no mathematical significance whatever.

Modern physics has also shown that electricity itself has an atomic structure, with positively and negatively charged particles. The unit of negative electricity is called an electron; of positive electricity, a proton.

The Atom Model: Electrons

To return to the consideration of the atom, as previously mentioned the atom is conceived as being a miniature solar



Courtesy USDA B. P. I.

Fig. 1. Diagram of a phosphorus atom greatly enlarged to show the relative positions of its parts.

system. At the center or core is a positively charged nucleus round which the electrons as satellites move in one or more fixed orbits. This is illustrated in Figure 1. The simplest atom is that in which one electron rotates round a core of a single positive charge. This is the hydrogen atom. The heaviest is that of uranium, in which the nucleus has 92 unit positive charges. The electron is also given the name Beta radiation and in diagrams such as Figure 2 it is shown by the Greek letter B. In the case of radiophosphorus the electrons emitted have a maximum energy of 1.69 million electron volts. They will penetrate 2.8 millimeters of pure aluminum or 3 millimeters of glass or about 18 feet of air.

An atom as a whole does not exhibit any electrical charge; it is neutral. It therefore must contain an equal number of positive and negative charges which balance each other out, in other words, the total negative charge of the electrons neutralizes the positive charge on the nucleus. The nucleus and electron are so small that, according to the estimates of the physics experts, if an atom were blown up to the size of a balloon of a 60-foot diameter, the nucleus and each electron would be smaller than a tiny grain of sand. Thus we see that the atom is a very porous pile—tiny specks in an empty space.

The Proton

All of the properties of an element are determined by the size of the positive charge of its atomic nucleus. The simplest element is hydrogen and its nucleus has a positive unit charge. This charge is also known as the alpha ray. Because of this unit charge, the hydrogen nucleus is considered one of the elementary particles of matter and is called a proton.

The Neutron

There is another elementary particle found in the nucleus of atoms. This particle has almost the same weight as a proton, but differs from it in that it carries no electric charge. It is electrically neutral and therefore is called a neutron. The number of neutrons present in an atomic nucleus is equal to the difference between the atomic weight and the number of protons it contains as indicated by its place in the periodic table. For example the nucleus of ordinary hydrogen contains one proton and no neutrons. Helium, which is second in the table with an atomic weight of four, contains 4-2 or 2 neutrons and therefore 2 protons.

For the present discussion we may

consider protons, electrons, and neutrons as the ultimate building bricks of matter. So we see that the element which in pre-radium days was considered indivisible and ultimate is not an element at all. It is an exceedingly complex structure which is divisible into more elemental constituents.

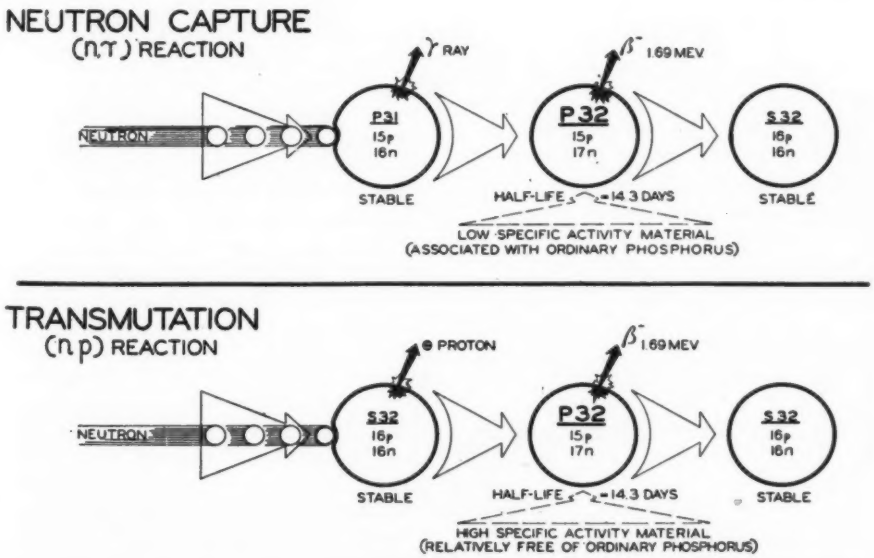
Isotopes

Previously it was mentioned that Dalton's Atomic Theory implies that the atoms of an element are identical. About 1919 the Englishman, Aston, discovered that the element neon had two groups of atoms, each group differing by weight from each other. This was something that upset Dalton's theory, for the evidence was definite that an element might have two kinds of atoms, of different weight, but with the same chemical properties. The name "isotope" was coined to describe each member of such a group. In plain language an isotope is an atomic twin with the distinguishing feature that it is different in weight. There are two kinds of isotopes: a normal unchanging kind, and a radioactive kind.

Radioisotopes

The isotope which is identical chemically with its normal, stable twin, but differs in that it emits radiant energy is called a radioisotope. The radioactivity may be likened to a tiny explosion in consequence of which the nucleus bursts. Electrons and the shattered nucleus shoot out with tremendous force accompanied by radiant energy. The radioisotopes furnished by Oak Ridge emit beta and gamma radiations, the gamma being similar to X-rays.

To produce radioisotopes it is only necessary to change the number of protons in the nucleus either by adding one or more neutrons or by expelling some of the neutrons already there. Although that is no simple process, it is possible now to do this at relatively low cost. In the atomic furnaces at Oak Ridge the process is accomplished in what is called the reaction pile. One or more neutrons shot into a nucleus may be held captive for a certain length of time to form a radioisotope. (See Figure 2.) In the diagram we see how a neutron is forced into an atom of



Courtesy Atomic Energy Commission

Figs. 2 & 3. Diagrams showing how atoms are changed into isotopes or other elements.

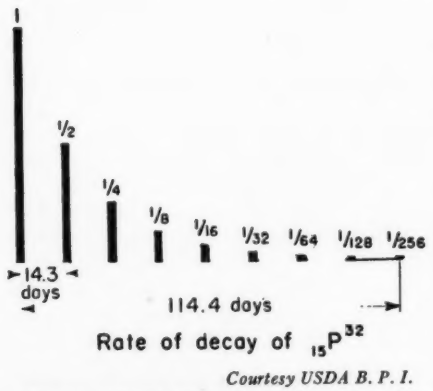
ordinary phosphorus whose nucleus contains 15 protons and 16 neutrons. The invading neutron enters, producing the radiophosphorus isotope with 15 protons and 17 neutrons. Eventually this radiophosphorus isotope loses its radiant energy and becomes a stable sulfur atom with a nucleus having 16 protons and 16 neutrons.

The radiophosphorus isotope may also be produced by the process called transmutation. This is illustrated in Figure 3. A neutron is shot into the nucleus of a sulfur stable atom having 16 protons and 16 neutrons, and in so doing drives out one proton. The nucleus then has 15 protons and 17 neutrons. Such a nucleus identifies a radiophosphorus isotope. In time this isotope loses its energy and becomes again a stable sulfur atom as shown.

For convenience the mass or weight of a nucleus is written as a superscript to the chemical symbol. Example P^{31}. Or the weight may just follow it. Example C14. The positive charge is written as a left subscript. Example $_{15}P^{31}$ and is equal to the number of protons.

Half-Life

In Figures 2 and 3 the phrase "half-life" is used. This refers to the rate at which the radioisotope disintegrates per second. This rate is measured like any other rate of speed such as miles per hour, or feet per second. This is illustrated in Figure 4. Each radioisotope has a relatively constant speed of decay known as its half-life, which is the period of time it takes to fall to one-half of the initial value. It can be compared to the length of time it takes an auto to slow down from 40 to 20 miles per hour, 20 to 10, 10 to 5, 5 to 2.5, and so on. Boron radioisotope has a half-life of 1/50th second; radiophosphorus 14.3 days; radiopotassium, 42, 12.4 hours; radiocalcium 45, 180 days; and radiocarbon 14, about 5,000 years.

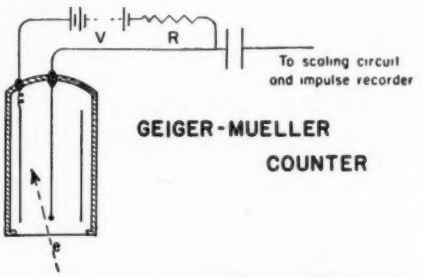


Courtesy USDA B. P. I.

Fig. 4. Rate of decay of a radioactive isotope of phosphorus.

The Geiger-Mueller Counter

Although they have identical chemical properties with their normal, stable twins, radioisotopes, being radioactive, can be detected or traced by appropriate instruments. The beta radiation is like a tag by which it can be followed. It is this feature that gives them their outstanding importance in the domain of scientific research. An infinitely tiny speck of such an isotope can be traced through the most intricate biochemical process whether in plant or animal, or human. The substance being traced can be diluted by a factor of a million or more, a quantity beyond the limits of chemical analysis. Detection is made possible by a sensitive instrument named after its inventors, the Geiger-Mueller Counter. So long as a mere trace of radiation is emitted, the Counter will detect it. See Figure 5 for a diagram of the Geiger Counter. The diagram



Courtesy USDA B. P. I.

Fig. 5. The Geiger-Mueller Counter.

will have to suffice as explanation of this valuable adjunct to radioisotopic tracer technique.

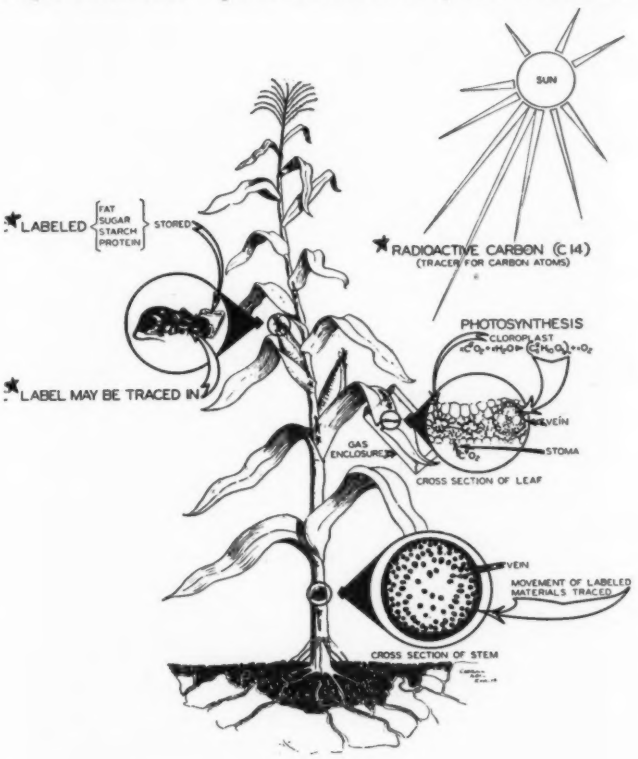
The instrument is sensitive to the passage of electrons. A specially prepared tube registers when ionized particles strike it. The electrical disturbance or ionization induced by the electrons is amplified within the tube so that it can be recorded in the form of a click sound, the ringing of a bell, or register mechanically on a dial. Many types of counters are available, from vest-pocket size to large, permanent laboratory installations.

Isotopic Tracer Technique

With the foregoing information as a background it will be easier to understand the so-called isotopic tracer technique. This technique as previously hinted is based on the fact that a radio-active nucleus "explodes" and in so doing hurls out Beta rays, or electrons. By means of the Counter, these electrons can be detected and if the half-life of the isotope is long enough as is the case with radiophosphorus or radiocalcium, it will be possible to follow or trace behavior of the radioisotope throughout its course of activity. An example will help explain the technique.

Remember a radioisotope is identical in its chemical behavior with its non-radiant atomic twin. The example we shall describe involves phosphate reactions, and specifically the fertilization of a plant with superphosphate as the source of the phosphorus nutrient.

The investigator prepares a superphosphate in which he introduces a specified amount of radiophosphorus into so many superphosphate molecules. By means of the Counter, the worker determines the proportion of radiophosphorus to ordinary phosphorus in the superphosphate he plans to use as fertilizer. This is called the "specific activity." When this fertilizer is added to a soil upon which a crop is to be grown, the radioactivity of a unit quantity of phosphate separated from the plant is taken as the amount of phosphate contributed by the radioactive



RADIOACTIVE TRACER ILLUSTRATION

Courtesy Atomic Energy Commission

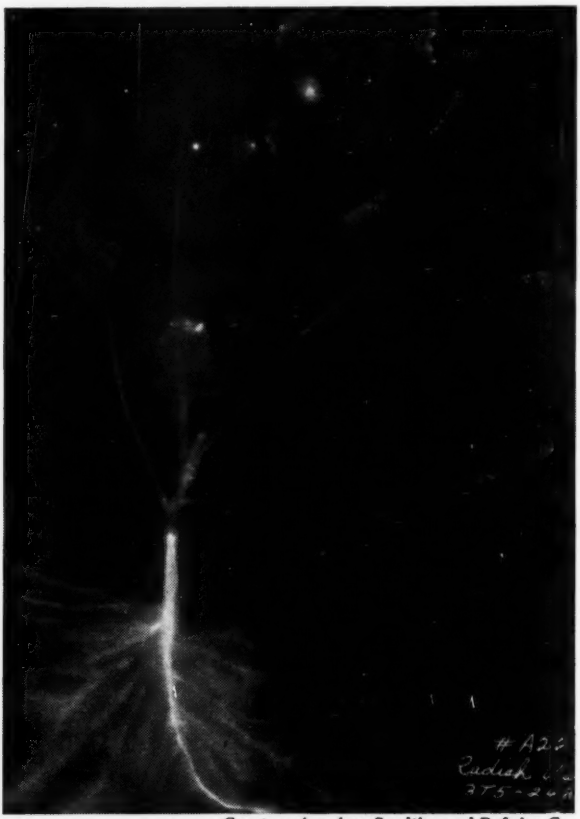
Fig. 6. How radioactive isotopes are used to investigate physiological activities in the plant.

fertilizer. For example, if the phosphate in the plant specimen is only one-third as active per milligram as that in the fertilizer only one-third of the total phosphate was derived from the applied fertilizer.

Figure 6 illustrates the tracer technique. Radioisotope carbon (C14) is used as the tracer for carbon atoms and is designated with a star superscript C*. The diagram shows how specimens from different tissues and from the kernel can be taken and analyzed for its radiocarbon content. The corn that is eaten by the rat would have a specific activity of the C* and the latter can be traced throughout the metabolism of the rat.

Because it is possible to detect extremely low concentrations of a radioisotope the investigator can work with very dilute solutions, for example, corresponding to the dilute solutions of nutrients found in soils which are beyond the range of chemical analysis.

Another phase of tracer technique is that illustrated in Figure 7, the radioautograph. The very small amount of a radioisotope which passes into a plant in the course of a few hours say from a normally fertilized soil or a dilute solution is enough to register itself on a photographic plate or film. Leaves or parts of a plant containing a radioactive element are pressed against the film enclosed in a light-tight paper envelope. The radiation produces the contact image as shown. The figure shows radioarsenic as it has distributed itself throughout a radish plant 24 hours after it was fed into the nutrient solution. Note the concentration in the roots. One can appreciate how such radioautographs could be used by those who are developing better methods of tissue-testing for determining nutrient deficiencies.



Courtesy American Smelting and Refining Co.

Fig. 7. Radioautograph of radish plant 24 hours after being fed radioarsenic in the nutrient solution showing accumulation in the roots.

Effect of Radioactive Isotope on Plant Growth

One of the first questions that is usually asked is what effect if any does the radioactivity have on the normal processes of plant growth. What proof is there that

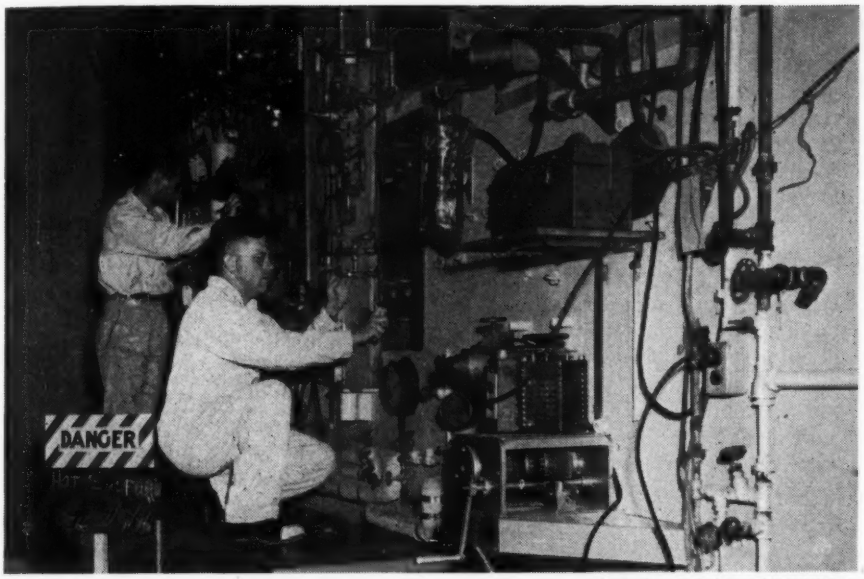


Photo by U. S. Army Signal Corps

Fig. 8. Two operating chemists at controls and periscopes view the chemical process for separating the dangerously radioactive fission products of uranium. The operators are protected by thick concrete and lead.

the radiation does not affect these processes adversely and thus vitiate the test?

These questions have been carefully looked into by the investigators. The scientists of the U. S. Department of Agriculture Bureau of Plant Industry, Division of Fertilizers, with such questions in mind checked into the problem. In one experiment they studied the effect on the growth of rye grass of adding 0.075, 0.375, and 1.875 millicuries [1] of P^{32}—which are high levels of radioactivity—to 3 kilograms of soil. Three different soils were used and three phosphatic fertilizer materials into which P^{32} had been incorporated. They found no significant effects that could be attributed to the radiation. Other research confirms the fact that the concentration of radioactivity that is ordinarily used in any experiment with radioactive fertilizers will not adversely affect plant growth.

Dr. Lyman A. Dean summarized the results of his tests with rye in Table I.

It cannot be emphasized too strongly that radioisotopes are exclusively tools of research. Claims are being made by some persons that radioactive fertilizers have given remarkably higher yields than could possibly be expected from ordinary fertilizers. The U. S. Department of Agriculture and the Oak Ridge authorities who are best competent to judge these claims emphatically refute them as being unfounded on any facts known up to this time.

TABLE 1—EFFECT OF DIFFERENTIAL APPLICATIONS OF P^{32} ON THE GROWTH OF RYE GRASS

	Yield of Tops (grains)			
P^{32} applied M.C./pot.	1st Cutting	2nd Cutting	3rd Cutting	4th Cutting
0.75	1.51	2.21	2.20	2.67
0.375	1.56	2.20	2.15	2.57
1.875	1.67	2.26	2.16	2.50

[1] A millicurie is the unit of measure of radiation equal to that of 0.001 gram of radium and is equivalent to 37×10^6 disintegrations per second.

Review of Radioisotopic Research

Although the chemical and biological sciences have contributed greatly to the advance of agriculture, it is still faced with many problems which need for their solution much more fundamental knowledge than can be had from chemistry and biology, alone. The remarkable progress made so far by the tracer technique gives promise that here at last is the key with which to unlock some of Nature's guarded secrets.

Because it is relatively simple and economical to produce P^{32} at the Oak Ridge reaction pile and since this isotope has a conveniently long half-life, more research has been reported involving it than the isotopes of other plant nutrients.

Radiophosphorus

Undoubtedly the most comprehensive research up till now with radiophosphorus is that reported at the symposium on radioisotopes held at the November 1947 annual meeting of the American Society of Agronomy. The feature of that symposium was the reports from the radioactive phosphorus project sponsored jointly by the Fertilizer Industry Phosphate Research Committee and the Bureau of Plant Industry, the North Carolina Agricultural Experiment Station and the Cornell Agricultural Experiment Station. During its first year the project had the full-time services of five and the part-time services of at least ten scientists. Under the skilled organizational ability of the administrators and the exceptional experience in radioactive work of Dr. Lyman A. Dean and Dr. Sterling B. Hendricks of the Division of Fertilizers and Soils of the Bureau of Plant Industry, the project made remarkable progress as revealed by the symposium papers.

For the present year, the administrative leaders in cooperation with the Phosphate Research Committee have organized comprehensive regional programs. The purpose is to embrace within the program all the major soil types of the country. In addition to the program at the North Carolina and the

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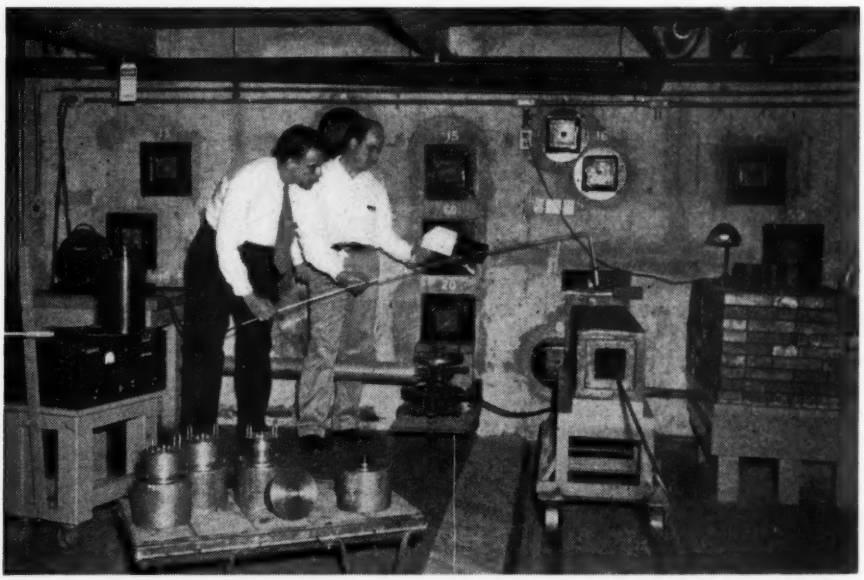

Photo by U. S. Army Signal Corps

Fig. 9. Operator removes the can of radioisotopes from pile. Health physicist is monitoring sample.

Fig. 1. Mississippi's average corn yield is 16 bu. per acre, with Caledonia community averaging 21 bu. per acre. In the demonstration program the community average was 79.6 and the local winners averaged 113.8 bu. per acre.

Hitting The Target: 100 Bu. Corn Per A.

By C. W. Makamson

Veterans' Instructor, Caledonia, Mississippi

IN the Caledonia Community, Lowndes County, Mississippi, 60 farmers produced 5,572 bushels of corn on 70 acres, an average of 79.6 bushels per acre. Of this number, 11 acres yielded from 100 to 144.4 bushels per acre. How was this done? Here is the story, and some 800 out-of-the-county folks and 800 Lowndes Countians who saw and studied many of these projects will verify these facts.

1946

In 1946, R. B. Caldwell, a farmer cooperating with the Soil Conservation Service, planted one acre of Tennessee 10 hybrid corn following the North Carolina plan. The land preparation, fertilizer requirements, and other details were worked out and closely supervised by B. T. Waldrip of S.C.S. (The Lowndes County S.C.S. recommendations include close foliage to protect the soil from heavy impact of rain, and better land use by producing on one acre what is commonly grown on five acres.) Mr. Caldwell produced 104.8 bushels of corn on this acre.

There were five major points or steps which he followed in growing this acre. Briefly, they are: 1—Use enough fertilizer to make 100 bushels; 2—Place

fertilizer 8 inches deep; 3—Plant an adapted hybrid strain of corn; 4—Leave enough stalks to hold ears; 5—Cultivate early and lay-by about knee-high. (Each of these will be discussed in detail in succeeding paragraphs.)

We of the Vocational Agriculture Department cooperated with Mr. Waldrip and the Soil Conservation Service in using Mr. Caldwell's field for instruction. Farmers, business men, veterans on-the-farm classes, Future Farmers, and agriculture leaders visited and studied this plot. A big field day climaxed the affair and some 75 to 100 farmers estimated yield. Prizes in the form of seed corn (T-10) from Lowndes County Cooperative and groceries from local merchants were given to the best estimators. So ended 1946: One acre T-10 corn following an organized plan with a yield of 104.8 bushels.

1947

In the winter and early spring of 1947, the S.C.S. and Vocational Department taught classes to 40 veterans, 40 Future Farmers, and several farmers; giving specific instruction in fertilizers, depth placement, stalks left, seed corn, and laying-by. There were many contacts, visits, and discussions to stimulate interest and to put the corn on the ground. Then, in addition to this, most plots were closely supervised in the field. Ended 1947: 70 acres planted averaging 79.6 bushels per acre, with the seven high producers averaging 113.8 bushels per acre. (See Fig. 1).

Five Point Plan

1. ***Meet fertilizer requirements.*** One hundred bushels of corn require 140 pounds of pure nitrogen, 50 pounds of pure phosphorus, and 100 pounds of potash. These requirements were met in many ways. Following is a list of some of the materials used: barnyard manure, superphosphate, basic slag, cover crops, nitrate of soda, ammonium nitrate, muriate of potash, and commercial mixed fertilizers with these analyses, 5-10-5, 4-8-4, 4-10-4, 4-8-8, 6-8-4, 6-8-8, and 7-10-7. Where it was available six tons of manure, broadcast, were recommended.

It is important to note the value of barnyard manure in this plan. It was broadcast and cut in as the farmer began soil preparation. Good manure supplies 10 pounds nitrogen, 5 pounds phosphorus, and 10 pounds potash for each ton used. In addition, it adds organic matter and makes a more effective use of other nutrients.

TABLE 1. FOUR EXAMPLES SHOWING THE AMOUNTS AND COMBINATIONS OF FERTILIZERS WHICH FOUR FARMERS USED IN MEETING FERTILIZER REQUIREMENTS

Materials used	N	P	K
Cover crop (good)	16	0	0
6 tons manure	60	30	60
500# 4–8–8	20	40	40
150# ammonium nitrate	48	0	0
Total	144	70	100

Materials used	N	P	K
6 tons manure	60	30	60
800# 5–10–5	40	80	40
300# nitrate of soda	48	0	0
Total	148	110	100

Materials used	N	P	K
900# nitrate of soda	144	0	0
300# superphosphate	0	60	0
200# muriate of potash	0	0	100
100# 6–8–4	6	8	4
Total	150	68	104

Materials used	N	P	K
6 tons manure	60	30	60
100# potash	0	0	50
100# 4–8–8	4	8	8
250# ammonium nitrate	80	0	0
400# slag	0	32	0
Total	144	70	110

Fig. 2. The State vocational agriculture leaders who visited the local demonstration on the Lagrone farm.

Cover crops add organic matter and supply nitrogen which reduces cash cost of fertilizers. Cover crops may displace nitrates as follows:

Excellent growth and stand—300# of nitrate of soda or 150# ammonium nitrate.

Good growth and stand—200# of nitrate of soda or 100# ammonium nitrate.

Fair growth and stand—100# of nitrate of soda or 50# ammonium nitrate.

In many cases we found that a farmer could sit down and figure his fertilizer requirements from available and cheaper sources, thus saving a cash expense of from 20 to 50 per cent.

2. ***Place fertilizer 8 inches deep.*** This is crop insurance. It puts the roots deep, thus staving off severe burning during prolonged droughts. In a dry year this means the difference between a loss and a profit. Our corn went from 22 days in part of the district to 31 days in other parts without a rain. This was in the most critical period, during tasseling and silking, as all of this corn was planted in May and June. Perhaps the dates on which we had rain will give a better evaluation of the resistance of this corn to dry weather—from July 14 and 15 to August 8 and 10 in the southern half, and from July 14 and 15 to August 14 in the northern parts. Farmers know that their yields were cut severely, and practically all believe that each would have reached his goal of 100 bushels with a normal amount of rainfall.

The method used in getting fertilizers 8 inches deep varied with each individual. However, the most common way was to run a bull-tongue in a middle buster furrow (make two trips with bull-tongue if necessary), then follow with a fertilizer distributor. One farmer put a foot underneath his Farmall and made two trips. He got more than 8 inches deep. Another had a hired hand ride the trail plow of his John Deere carrying a 10-inch shovel.

For the most part, just as good or better results have been obtained when all the fertilizers were applied before planting the corn. However, when the soil is predominantly sandy and where considerable leaching occurs, ⅔ of the nitrate applied under and ⅓ applied as a side-dressing are recommended.

3. *Plant an adapted hybrid strain of seed corn.* The recommended hybrids used in our locality were Dixie 11, Tennessee 10, and Funk's G-714. The participants in these projects of 100-bushel corn production planted as follows: 54 planted Tennessee 10; 3 planted Dixie 11; 2 planted Funk's G-714; and one planted an open-pollinated variety.

In developing hybrid strains of corn, breeders try to combine the good qualities and eliminate the inferior qualities. We are not in a position to say that one hybrid is the best; however, we do think that in this high production, a hybrid will do better than open-pollinated varieties of corn. This is from field observations, and we have no conclusive proof.

4. *Leave enough stalks to hold 100 bushels.* This will take stalks 16 to 18 inches in the drill on 42-inch rows, thereby giving between 8,000 and 12,000 hills per acre. From our study and observation, less stalks than the above cut the yield, whereas more stalks tend to give a crowded condition, resulting in smaller stalks and ears and more lodging. Most of the corn planted ranged from 15 to 20 inches in the drill and the rows ranged from 38 to 44 inches. However, it should be pointed out that some was planted as close as 10 inches in the drill, while other, due to insect damage and poor germination, was as far as 36 inches apart. Where proper fertilizers were applied and 8-inch depth placement followed, the yields were cut rapidly as the distance in the drill increased upward from 20 inches. We all know that it is necessary to leave enough stalks to hold the number of ears required to weigh out 100 bushels of corn. Normal and average corn usually takes 120 ears to make a bushel; however, it is more conservative and more nearly accurate to figure on 140 ears per bushel. At this rate it would take 14,000 ears to make 100 bushels, and to produce this it would take a minimum of 7,000 stalks, each producing two ears. Of course, every stalk isn't going to have two ears, so that makes it the more imperative to have 8,000 to 12,000 stalks to hold the ears of corn required to weigh out 100 bushels of good grain.

5. *Cultivate shallow and early.* One cultivation is all that is necessary in most cases. The corn grows very fast and begins to shade the ground quickly. The fertilizer is deep, and the weeds and grasses cannot readily get to it, thus eliminating the need for continuous cultivation. The shading also induces a longer supply of moisture.

Not too many roots begin to be plowed up before the corn is knee-high (24 to 36 inches). Consequently, it is important to cultivate early and lay-by at 24 to 36 inches. When this plan is properly followed, the

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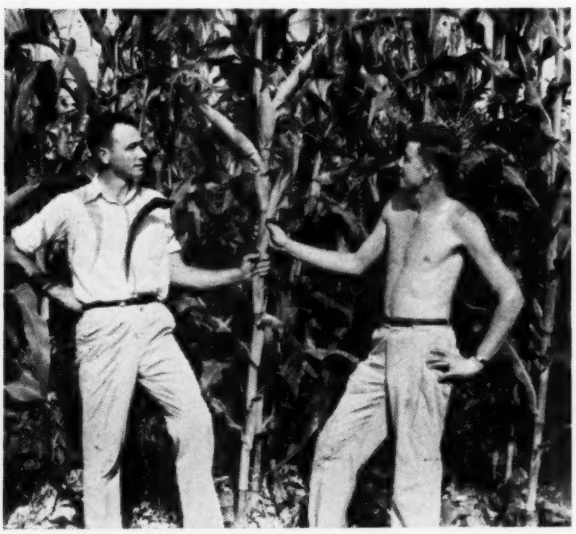


Fig. 3. Dan and Emmett Lagrone who won second place in the corn contest with an average yield of 126.9 bu. per acre.

Soil Conservation Service Photo

Fig. 1. Flat sandy Class I land on a north Florida farm has a good cover of blue lupine. This winter legume is an excellent crop to plant after peanuts are harvested and is being used extensively in the Coastal Plain sections of Georgia, Florida, South Carolina, Alabama, and Mississippi.

Ground Cover

By R. Y. Bailey

Soil Conservation Service, Spartanburg, South Carolina

GRASS was eulogized by the late John J. Ingalls as "The forgiveness of nature—her constant benediction." If I were gifted as he, I might use well-turned phrases to praise all ground covers, including grass, legumes, crop residues, vines, shrubs, and trees. Ground cover must be one of the future safeguards of Southern agriculture and industry.

Without ground cover, we shall continue to lose soil from cultivated slopes so that the productivity of cropland will be reduced still further. Lowlands will continue to collect deposits of sand and gravel, drainage ditches will be filled, stream channels will be choked with silt, and soil will continue to be deposited on highways during rainstorms.

With ground cover used in the right way, we can reduce erosion and increase the productivity of cropland. Deposits of sand and gravel will be kept off the fertile land along streams so that it can be cultivated or used for pasture. Drainage ditches will require less expensive cleaning, stream channels will maintain normal capacities, less silt will be deposited in reservoirs, and soil will not have to be removed from highways after heavy rains. Flood damage will be reduced and a better supply of water will be available for livestock and industrial use.

Soil Conservation Service Photo

Fig. 2. Kudzu provides perfect ground cover on steep slopes such as this one in Tennessee. If grazed so as to keep the ground covered with green leaves, kudzu protects land in Capability Classes IV, VI, or VII from erosion.

Cover of grass, legumes, and crop residues checks erosion at its source by cushioning the fall of raindrops and reducing to a minimum the breaking loose of soil particles. Plant cover also increases the absorption of water into the soil, thus maintaining more favorable ground water conditions.

The rate of erosion varies with such physical factors as slope of the land and soil type. The kinds and amounts of plant cover required for soil protection vary with these physical factors. Several different kinds or classes of land are found on a single farm. It naturally follows that each farm needs several kinds of plant cover.

Fitting vegetative cover to the land requires farm by farm, field by field planning. The Soil Conservation Service assists soil conservation districts with the making, application, and maintenance of soil and water conservation plans on farms in the districts. These plans must fit the needs of the land and the people on the land.

Farm soil and water conservation planning in districts is based on land capability. Land capability classification is based on physical factors that determine how the land can be used and the treatment required to keep it in condition for continuous, productive use.

Classes of Land Capability

Let's take a look at the land capability classes and consider the use for which each is suited and the treatment required to keep the land in good condition.

Cultivated land usually is the most valuable on the farm. There are four classes of cultivated land that are considered largely from the standpoint of their susceptibility to erosion. Other lands where erosion is not an important factor are grouped into sub-classes because of their need for drainage or because of their droughty, overdrained characteristics.

Recommended uses and treatments for the different classes of cultivated land are based on extensive observations on farms and on results from runoff plots. Three classes of cultivated land and several different rotations were included in studies on runoff plots. Measured results from these plots were in

terms of soil and water losses and crop yields.

Class I Land

Class I land is well drained, productive, and so nearly level that erosion is not an important factor. It will stand intensive cultivation for the production of row crops, provided cover crops are grown in winter to maintain organic matter and to keep the land in a highly productive condition.

Annual winter legumes such as the vetches, winter peas, and crimson clover are used extensively for winter cover and green manure in the South. Blue lupine is a popular winter cover crop in the sandy Coastal Plain soils of the lower South. Lupine is particularly well adapted on land where peanuts are grown for market.

Several winter annual legumes produce enough hard seed to carry over one or more years and give volunteer stands each fall after a good supply of seed has been built up in the soil. Grandiflora vetch, wild winter (Caley or Singletary) peas, and button clover are annual winter legumes that have shown promise as natural reseeders where the soil was well stocked with seed. Field results to date indicate that two successive green crops can be turned under and still leave enough hard seed in the soil for another volunteer crop.

After the soil is stocked by allowing a crop of seed to mature, corn or cotton may be grown two successive years and the next volunteer stand of legumes left to make seed. Grain sorghum may be planted after the winter legume seed is ripe, thus giving a late grain crop. If small grain is seeded in the fall after the second corn or cotton crop, the grain and the volunteer legume furnish winter grazing until animals are removed in the spring for the legume to make seed.

Where livestock production is a major enterprise, land in this class may be used intensively for winter grazing and grain production in a rotation similar to one developed at the Tennessee Valley Experiment Station at Belle Mina, Alabama. This rotation includes oats for grain the first year, with the stubble land fallowed for summer seeding of rye grass and crimson clover for

Soil Conservation Service Photo

Fig. 3. This mixed stand of loblolly and slash pine was planted on severely eroded Class VII land in Alabama in the spring of 1936. Excellent protection against erosion was being furnished by the trees when this photograph was made in October 1947.

grazing. The winter-grazing mixture is pastured until the plants are ready to make seed in the spring. After seed is harvested, the land is plowed and planted to grain sorghum.

The hard-seeded strains of crimson clover, button clover, and other reseeding legumes offer possibilities in even more intensive grazing rotations. These legumes may fit into cropping systems in which a small grain or rye grass and a winter legume are pastured each winter and a crop of grain sorghum grown each summer.

The relationship between the cropping treatment and the class of land is important. Summer fallowing sometimes results in severe soil losses on sloping land, whereas it is a safe practice on flat land where there is no erosion.

Class II Land

A second class of land on which there usually is moderate erosion because of slope, soil type, and other factors is placed in class II. Land in this class requires contour tillage and usually needs terraces and other water-disposal measures. These mechanical measures are important, but they are not enough to prevent erosion, nor do they maintain organic matter in the soil. Rotations that include one year of cover and a year of cultivation are about right for land in this class.

A simple 2-year rotation that fits well on soils where sweet clover is adapted is: 1st year, oats with sweet clover seeded on oats early in the spring; and, 2nd year, green sweet clover turned under for cotton, corn, or another cultivated crop. Numerous other short rotations may be used, but this one serves to illustrate the amount of ground cover needed for the particular class of land.

Class III Land

Land in capability class III requires complete water-disposal methods including terracing, vegetated outlets at terrace ends, contour tillage, and a strong rotation. Results on runoff plots at the Southern Piedmont Soil Conservation Experiment Station, Watkinsville, Ga., show that land in this class needs effective ground cover at least two years out of every three.

This is an important class of land because there is so much of it. In many of the principal farming areas of the Southeast, fully half the cultivated land is in class III. If we neglect or misuse this extensive acreage of sloping cropland, our agriculture will be badly crippled.

At Watkinsville, a three-year rotation of oats and sown lespedeza the first year, lespedeza hay the second year, and cotton the third year kept soil losses down to a fairly low figure. Most of the soil was lost during the cotton year of the rotation, which emphasizes the need for keeping to a minimum cultivation of land in this class. Cropping systems that were effective on class II were found to be too weak to protect land in class III.

Rotations that include a perennial grass and clover mixture or an alfalfa-grass mixture with only one row crop and a small grain crop in four or five years are even better for class III land than the lespedeza rotation used at Watkinsville. In areas where livestock production is a major farm enterprise, such rotations fit well into the farm program.

Also, where feed is needed, more small grain and hay crops and other protective cover can be used on class III land than in areas where row crops are the principal sources of income. Alfalfa has a much wider adaptation since state agricultural experiment stations have developed soil treatments to maintain stands on soils where alfalfa once was considered not adapted.

Management of alfalfa so that enough top growth is left uncut in the fall to maintain vigorous stands also increases the value of alfalfa as a ground cover. Mixtures of alfalfa and orchard grass are more protective than alfalfa alone.

(*Turn to page* 38)

Soil Conservation Service Photo

Above: **Wild winter peas on a Mississippi farm came up to a thick volunteer stand. This legume fits well on Class I or other level land where row crops are grown intensively.**

Below: **Class III land on this Virginia farm is under a 3-yr. rotation of corn, small grain, and a grass-legume hay mixture. This gives protection and maintains a high level of soil productivity.**

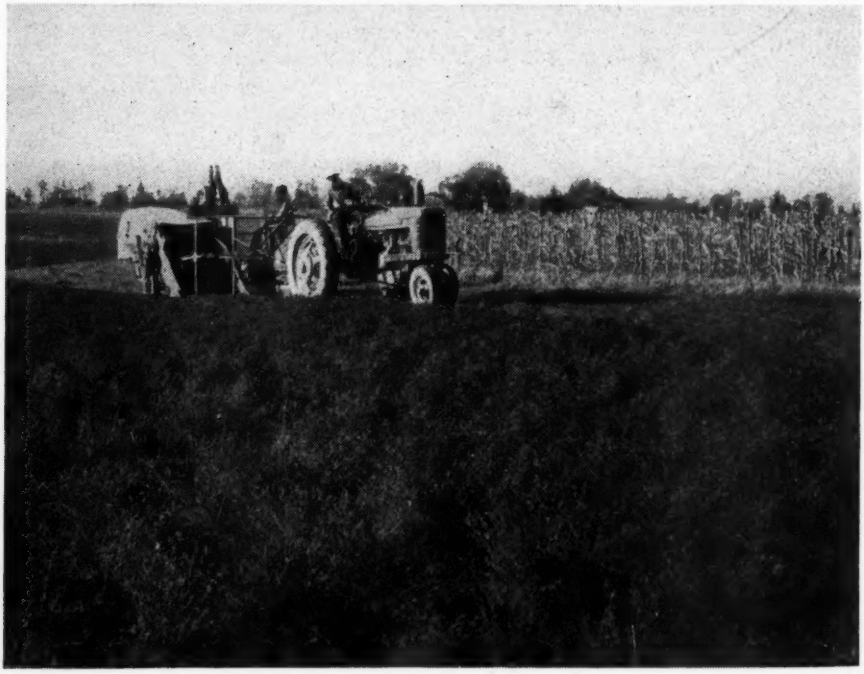
Soil Conservation Service Photo

Soil Conservation Service Photo

Above: **A volunteer stand of crotalaria is being returned to this deep, overdrained, sandy soil in North Carolina. It supplies organic matter to maintain favorable internal condition where erosion is not serious.**

Below: **Annual lespedeza on a South Carolina farm protects this field of Class II and III land from erosion, and the residue left after seed is harvested manures the soil to increase its productivity.**

Soil Conservation Service Photo

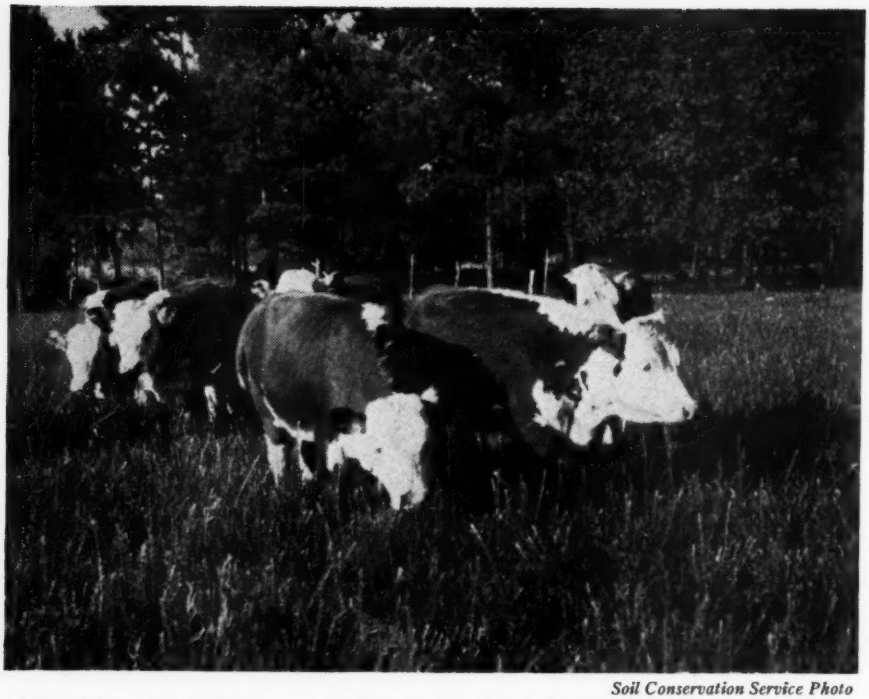


Soil Conservation Service Photo

Above: **Kentucky 31 fescue and Ladino clover made excellent cover on an upland area in Tennessee. This mixture also makes good growth on Class V and other wet lands. It adds much to the completeness of soil and water planning, making possible the profitable use of waste land.**

Below: **A mixture of alfalfa and orchard grass protects Class III land in Tennessee while furnishing excellent pasture for beef cattle.**

Soil Conservation Service Photo



Soil Conservation Service Photo

Above: **Sericea is a good cover for land in Capability Classes IV and VI. It makes good hay and is a good pasture plant as shown by these cattle on a South Carolina farm.**

Below: **Shrub lespedeza next to woodland and sericea next to the cultivated land protect the unproductive area along row ends from erosion and furnish food and cover for wildlife on a Georgia farm.**

Soil Conservation Service Photo

The Editors Talk

Atomic Energy and Farmers

Whenever anything new in research appears upon the horizon, there is always much speculation as to the extent of its usefulness. This particularly has been true of atomic energy, and the recent employment of radioisotopes in agricultural research has resulted in widespread queries among farmers as to the effect on crop production. "Will radioactive fertilizers increase the yields?" "Will they retard or kill plant growth?" "Where can they be purchased?" These and other questions are current this spring.

It was gratifying, therefore, to have David E. Lilienthal, Chairman of the U. S. Atomic Energy Commission, release to the press his "down-to-earth" talk given before the annual meeting of the American Farm Bureau Federation this winter. After dwelling upon its military significance, Mr. Lilienthal brought atomic energy into agriculture with, incidentally, a nice tribute to farmers.

"We depend—all of us—upon you, the farmer, for our human energy," he said. "We depend upon you for the energies that produce great poems, that build churches and homes, the energies from which spring such noble ideas as our Constitution and Bill of Rights. That energy has been stored up in the plants of the field, and in the tissues of the animals that feed on your pastures; thence it comes to men.

"Where does that energy come from; where do the plants get it? As we all know it comes from the sun. This is familiar to every school child. But what is not well known is that the sun is an atomic energy factory. In the sun forces within the atom's nucleus are released and then transmitted to earth and caught and stored up in plants. The farmer then, since time immemorial, has had much to do with atomic forces, for he is at the center of the majestic energy-transmitting function, the function of those who till the soil and raise the food of the world.

"The farmer may be called the trustee and steward of that never-ending miracle by which the atomic energy of the sun becomes chemical energy and then human energy. Who then has a greater stake in seeing to it that more and more is known about this fundamental force of nature, and that its fruits are applied, than he who season following upon season watches over this life-giving process?"

On the application of atomic energy in the agricultural field, Mr. Lilienthal is of the opinion that in the main it will come through research using the by-products—the radioisotopes—from the reactors operated for the people of the United States by the Commission. "Do not, I urge you, take any stock at this stage in the vivid claims of great stimulation of growth and production by use of radioactive materials directly on the farm as fertilizers or in feeds," he said. "These are not tested and proved. Look to the men at your federal and state agricultural experiment stations for the facts on these matters. You can trust them. As practical farming applications are formed they will let you know. . . . For greater production per unit of plow or pasture land we look to the plant

scientists and they are moving rapidly aided by the use of radioisotopes, and by other means, to unlock new knowledge of plant growth which may magnify each year's production from the land of the earth and the toil of the farmers."

In this issue of Better Crops With Plant Food, we are pleased to present Dr. Vincent Sauchelli's discussion of radioisotopes as an indispensable aid to agricultural research. As Chairman of the Fertilizer Industry Phosphate Research Committee, he is in position to bring up-to-date the conclusions resulting from the application of atomic energy to fertilizers. We believe that these will be read and passed on with interest, particularly by those who wish to keep informed in their contacts with farmers.

Garden Again

To add to the usual inspiration to try one's hand (and back) at gardening, occasioned by the early circulation of enticing seed catalogs, we have had this year a flood of fine publicity on the continued importance of this activity in American life. From the economic, health, recreational, and even the political angles, people are being urged to garden. The "Victory" garden has given way to the "Freedom" garden. Secretary of State Marshall has said, "I don't think at any time in our history has it been more important that we raise all possible food during this coming season, than at the present time." That the American people can, and undoubtedly will, respond has been proven. Let's dust off the spades, the rakes, and the hoes and garden again.

Pasture Fertilization

We believe that American dairymen, by and large, are neglecting their pastures. They are failing to fertilize the fields which they devote to permanent pasture. They are not studying the grasses and legumes to determine which are best to use in order to provide the most nutritious pastures during the grazing season.

For many years it was thought that bluegrass was the outstanding crop for permanent pasture in the northern section of our country. We now know that bluegrass is one of the poorest pasture crops, if we are looking for efficient production. It only lasts a few weeks. Unless the land is exceptionally rich and there is an unusual amount of moisture, it starts to ripen in about four weeks and is poor milk-producing pasture.

What is needed is legumes and grasses that remain palatable and nutritious during the entire summer. We have found that "good, old Kentucky bluegrass" provides good pasture for only a few weeks. There should be another grass or legume to follow, otherwise pastures will be of little value to profitable milk production. In other words, we need to pay more attention to pasture fertilization and to the type of grass or legumes grown in order to keep good pasture before our cows from early spring until late fall.—*Hoard's Dairyman*, Oct. 10, 1947.

Season Average Prices Received by Farmers for Specified Commodities *

Crop Year	Cotton Cents per lb.	Tobacco Cents per lb.	Potatoes Cents per bu.	Sweet Potatoes Cents per bu.	Corn Cents per bu.	Wheat Cents per bu.	Hay Dollars per ton	Cottonseed Dollars per ton	Truck Crops
	Aug.-July	.....	July-June	July-June	Oct.-Sept.	July-June	July-June	July-June	....
Av. Aug. 1909–July 1914	12.4	10.0	69.7	87.8	64.2	88.4	11.87	22.55	....
1923	28.7	19.0	92.5	120.6	82.5	92.6	13.08	41.23	....
1924	22.9	19.0	68.6	149.6	106.3	124.7	12.66	33.25	....
1925	19.6	16.8	170.5	165.1	69.9	143.7	12.77	31.59	....
1926	12.5	17.9	131.4	117.4	74.5	121.7	13.24	22.04	....
1927	20.2	20.7	101.9	109.0	85.0	119.0	10.29	34.83	....
1928	18.0	20.0	53.2	118.0	84.0	99.8	11.22	34.17	....
1929	16.8	18.3	131.6	117.1	79.9	103.6	10.90	30.92	....
1930	9.5	12.8	91.2	108.1	59.8	67.1	11.06	22.04	....
1931	5.7	8.2	46.0	72.6	32.0	39.0	8.69	8.97	....
1932	6.5	10.5	38.0	54.2	31.9	38.2	6.20	10.33	....
1933	10.2	13.0	82.4	69.4	52.2	74.4	8.09	12.88	....
1934	12.4	21.3	44.6	79.8	81.5	84.8	13.20	33.00	....
1935	11.1	18.4	59.3	70.3	65.5	83.2	7.52	30.54	....
1936	12.4	23.6	114.2	92.9	104.4	102.5	11.20	33.36	....
1937	8.4	20.4	52.9	82.0	51.8	96.2	8.74	19.51	....
1938	8.6	19.6	55.7	73.0	48.6	56.2	6.78	21.79	....
1939	9.1	15.4	69.7	74.9	56.8	69.1	7.94	21.17	....
1940	9.9	16.0	54.1	85.5	61.8	68.2	7.58	21.73	....
1941	17.0	26.4	80.7	94.0	75.1	94.5	9.67	47.65	....
1942	19.0	36.9	117.0	119.0	91.7	109.8	10.80	45.61	....
1943	19.9	40.5	131.0	204.0	112.0	136.0	14.80	52.10	....
1944	20.7	42.0	149.0	192.0	109.0	141.0	16.40	52.70	....
1945	21.2	36.6	143.0	204.0	127.0	150.0	15.10	51.10	....
1946	28.3	38.2	124.0	219.0	136.0	185.0	17.30	71.40	....
1947									
February	30.56	31.9	131.0	228.0	123.0	199.0	17.50	88.20	....
March	31.89	33.6	139.0	235.0	150.0	244.0	17.40	88.00	....
April	32.26	30.1	147.0	233.0	163.0	240.0	17.20	88.00	....
May	33.50	44.6	153.0	233.0	159.0	239.0	16.80	83.70	....
June	34.07	46.0	156.0	249.0	185.0	218.0	16.00	79.60	....
July	35.88	48.5	169.0	251.0	201.0	214.0	15.10	79.00	....
August	33.15	38.1	161.0	270.0	219.0	210.0	15.30	75.50	....
September	31.21	40.7	149.0	240.0	240.0	243.0	16.10	75.60	....
October	30.65	41.6	150.0	205.0	223.0	266.0	16.80	90.60	....
November	31.87	40.0	166.0	195.0	219.0	274.0	17.30	89.10	....
December	34.06	46.9	172.0	204.0	237.0	279.0	18.10	94.80	....
1948									
January	33.14	45.9	186.0	217.0	246.0	281.0	187.0	95.10	....
Index Numbers (Aug. 1909–July 1914 = 100)									
1923	231	190	133	137	129	105	110	183	....
1924	185	190	98	170	166	141	107	147	143
1925	158	168	245	188	109	163	108	140	143
1926	101	179	189	134	116	138	112	98	139
1927	163	207	146	124	132	135	87	154	127
1928	145	200	76	134	131	113	95	152	154
1929	135	183	189	133	124	117	92	137	137
1930	77	128	131	123	93	76	93	98	129
1931	46	82	66	83	50	44	73	40	115
1932	52	105	55	62	50	43	52	46	102
1933	82	130	118	79	81	84	68	57	91
1934	100	213	64	91	127	96	111	146	95
1935	90	184	85	80	102	94	63	135	119
1936	100	236	164	106	163	116	94	148	104
1937	68	204	76	93	81	109	74	87	110
1938	69	196	80	83	76	64	57	97	88
1939	73	154	100	85	88	78	67	94	91
1940	80	160	78	97	96	77	64	96	111
1941	137	264	116	107	117	107	81	211	129
1942	153	369	168	136	143	124	91	202	163
1943	160	405	188	232	174	154	125	231	245
1944	167	420	214	219	170	160	138	234	212
1945	171	366	205	232	198	170	127	227	224
1946	228	382	178	249	212	209	146	317	204
1947									
February	246	319	188	260	192	225	147	391	275
March	257	336	199	268	234	276	147	390	299
April	260	301	211	265	254	271	145	390	295
May	270	446	220	265	248	270	142	371	286
June	275	460	224	284	288	247	135	353	215
July	289	485	242	286	313	242	127	350	189
August	267	381	231	308	341	238	129	335	211
September	252	407	214	273	374	275	136	335	179
October	247	416	214	233	347	301	142	402	238
November	257	400	238	222	341	310	146	395	272
December	275	469	247	232	369	316	152	420	294
1948									
January	267	459	267	247	383	318	158	422	320

Wholesale Prices of Ammoniates

	Nitrate of soda per unit N bulk	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory, bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.37	$3.52
1924	2.99	2.44	5.87	5.02	3.60	4.25
1925	3.11	2.47	5.41	5.34	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.32	5.70
1928	2.67	2.30	7.06	6.63	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.61	5.72
1930	2.47	1.81	4.78	4.96	3.79	4.58
1931	2.34	1.46	3.10	3.95	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.67	3.27
1935	1.47	1.15	4.59	3.10	3.06	3.65
1936	1.53	1.23	4.17	3.42	3.58	4.25
1937	1.63	1.32	4.91	4.66	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.76	4.43
1942	1.74	1.41	6.11	5.77	5.04	6.76
1943	1.75	1.42	6.30	5.77	4.86	6.62
1944	1.75	1.42	7.68	5.77	4.86	6.71
1945	1.75	1.42	7.81	5.77	4.86	6.71
1946	1.97	1.44	11.04	7.38	6.60	9.33
1947						
February	2.41	1.46	10.01	11.06	12.14	10.17
March	2.41	1.46	11.98	11.06	12.50	10.50
April	2.41	1.51	11.72	10.79	12.75	11.39
May	2.41	1.51	10.55	9.98	12.75	8.80
June	2.41	1.51	10.94	9.98	12.75	8.26
July	2.41	1.59	12.56	9.98	12.75	8.66
August	2.53	1.60	13.01	9.98	12.75	8.73
September	2.66	1.73	13.65	10.41	12.75	10.72
October	2.66	1.78	15.00	10.85	12.75	13.66
November	2.66	1.78	14.22	11.06	12.75	11.53
December	2.71	1.78	15.98	11.71	12.75	12.81
1948						
January	2.78	1.83	16.68	11.71	12.75	13.28
	Index Numbers (1910-14 = 100)					
1924	111	86	168	142	107	121
1925	115	87	155	151	117	135
1926	113	84	126	140	129	139
1927	112	79	145	166	128	162
1928	100	81	202	188	146	170
1929	96	72	161	142	137	162
1930	92	64	137	141	12	130
1931	88	51	89	112	63	70
1932	71	36	62	62	36	39
1933	59	39	84	81	97	71
1934	59	42	127	89	79	93
1935	57	40	131	88	91	104
1936	59	43	119	97	106	131
1937	61	46	140	132	120	122
1938	63	48	105	106	93	100
1939	63	47	115	125	115	111
1940	63	48	133	124	99	96
1941	63	49	157	151	112	126
1942	65	49	175	163	150	192
1943	65	50	180	163	144	189
1944	65	50	219	163	144	191
1945	65	50	223	163	144	191
1946	74	51	315	209	196	265
1947						
February	90	51	286	313	360	289
March	90	51	342	313	371	298
April	90	53	335	306	378	324
May	90	53	301	283	378	250
June	90	53	313	283	378	234
July	90	56	359	283	378	246
August	94	56	372	283	378	248
September	99	61	390	295	378	305
October	99	62	429	307	378	388
November	99	62	406	313	378	328
December	101	62	457	332	378	364
1948						
January	104	64	477	332	378	377

Wholesale Prices of Phosphates and Potash **

	Superphosphate Baltimore, per unit	Florida land pebble 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports[1]	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports[1]	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports[1]	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1]
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657
1924	.502	2.31	6.60	.582	.860	23.72	....
1925	.600	2.44	6.16	.584	.860	23.72	....
1926	.598	3.20	5.57	.596	.854	23.58	.537
1927	.525	3.09	5.50	.646	.924	25.55	.586
1928	.580	3.12	5.50	.669	.957	26.46	.607
1929	.609	3.18	5.50	.672	.962	26.59	.610
1930	.542	3.18	5.50	.681	.973	26.92	.618
1931	.485	3.18	5.50	.681	.973	26.92	.618
1932	.458	3.18	5.50	.681	.963	26.90	.618
1933	.434	3.11	5.50	.662	.864	25.10	.601
1934	.487	3.14	5.67	.486	.751	22.49	.483
1935	.492	3.30	5.69	415	.684	21.44	.444
1936	.476	1.85	5 50	.464	.708	22.94	.505
1937	.510	1.85	5.50	.508	.757	24.70	.556
1938	.492	1.85	5.50	.523	.774	15.17	.572
1939	.478	1.90	5.50	.521	.751	24.52	.570
1940	.516	1.90	5.50	.517	.730	24.75	.573
1941	.547	1.94	5.64	.522	.780	25.55	.367[1]
1942	.600	2.13	6.29	.522	.810	25.74	.205
1943	.631	2.00	5.93	.522	.786	25.35	.195
1944	.645	2.10	6.10	.522	.777	25.35	.195
1945	.650	2.20	6.23	.522	.777	25.35	.195
1946	.671	2.41	6.50	.508	.769	24.70	.190
1947							
February	.720	2.60	6.60	.535	.799	26.00	.200
March	.740	2.75	6.60	.535	.797	26.00	.200
April	.740	2.97	6.60	.535	.797	26.00	.200
May	.740	2.97	6.60	.535	.797	26.00	.200
June	.752	2.97	6.60	.330[1]	.589[1]	12.76[1]	.176
July	.760	2.97	6.60	.353	.629	13.63	.188
August	.760	3.08	6.60	.353	.629	13.63	.188
September	.760	3.42	6.60	.353	.629	13.63	.188
October	.760	3.42	6.60	.375	.669	14.50	.200
November	.760	3.42	6.60	.375	.669	14.50	.200
December	.760	3.42	6.60	.375	.669	14.50	.200
1948							
January	.760	3.42	6.60	.375	.669	14.50	.200

Index Numbers (1910-14 = 100)

1924	94	64	135	82	90	98	....
1925	110	68	126	82	90	98	....
1926	112	88	114	83	90	98	82
1927	100	86	113	90	97	106	89
1928	108	86	113	94	100	109	92
1929	114	88	113	94	101	110	93
1930	101	88	113	95	102	111	94
1931	90	88	113	95	102	111	94
1932	85	88	113	95	101	111	94
1933	81	86	113	93	91	104	91
1934	91	87	110	68	79	93	74
1935	92	91	117	58	72	89	68
1936	89	51	113	65	74	95	77
1937	95	51	113	71	79	102	85
1938	92	51	113	73	81	104	87
1939	89	53	113	73	79	101	87
1940	96	53	113	72	77	102	87
1941	102	54	110	73	82	106	87
1942	112	59	129	73	85	106	84
1943	117	55	121	73	82	105	83
1944	120	58	125	73	82	105	83
1945	121	61	128	73	82	105	83
1946	125	67	133	71	81	102	82
1947							
February	134	72	135	75	84	108	83
March	138	76	135	75	84	108	83
April	138	82	135	75	84	108	83
May	138	82	135	75	84	108	83
June	140	82	135	60	62	53	80
July	142	82	135	64	66	56	82
August	142	85	135	64	66	56	82
September	142	95	135	64	66	56	82
October	142	95	135	68	70	60	83
November	142	95	135	68	70	60	83
December	142	95	135	68	70	60	83
1948							
January	142	95	135	68	70	60	83

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and All Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer material‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash**
1924.....	143	152	143	103	97	125	94	79
1925.....	156	156	151	112	100	131	109	80
1926.....	146	155	146	119	94	135	112	86
1927.....	142	153	139	116	89	150	100	94
1928.....	151	155	141	121	87	177	108	97
1929.....	149	154	139	114	79	146	114	97
1930.....	128	146	126	105	72	131	101	99
1931.....	90	126	107	83	62	83	90	99
1932.....	68	108	95	71	46	48	85	99
1933.....	72	108	96	70	45	71	81	95
1934.....	90	122	109	72	47	90	91	72
1935.....	109	125	117	70	45	97	92	63
1936.....	114	124	118	73	47	107	89	69
1937.....	122	131	126	81	50	129	95	75
1938.....	97	123	115	78	52	101	92	77
1939.....	95	121	112	79	51	119	89	77
1940.....	100	122	115	80	52	114	96	77
1941.....	124	131	127	86	56	130	102	77
1942.....	159	152	144	93	57	161	112	77
1943.....	192	167	151	94	57	160	117	77
1944.....	195	176	152	96	57	174	120	76
1945.....	202	180	154	97	57	175	121	76
1946.....	233	203	177	107	62	240	125	75
1947								
February..	262	234	209	124	70	329	134	78
March.....	280	240	216	128	70	354	138	78
April.....	276	243	215	129	71	354	138	78
May.....	272	242	215	127	71	339	138	78
June.....	271	244	215	125	71	343	140	63
July.....	276	244	219	128	72	359	142	67
August....	276	249	223	130	75	364	142	67
September.	286	253	230	133	79	372	142	67
October...	289	254	230	136	80	387	142	71
November.	287	257	231	135	80	380	142	71
December..	301	262	236	138	81	400	142	71
1948								
January...	307	266	242	140	83	407	142	71

* U. S. D. A. figures. Beginning January 1946 farm prices and index numbers of specific farm products revised from a calendar year to a crop-year basis. Truck crops index adjusted to the 1924 level of the all-commodity index.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] All potash salts now quoted F.O.B. mines only: manure salts since June 1941, other carriers since June 1947.

**** The weighted average of prices actually paid for potash are lower than the annual average because since 1926 over 90% of the potash used in agriculture has been contracted for during the discount period. Since 1937, the maximum discount has been 12%. Applied to muriate of potash, a price slightly above $.471 per unit K_2O thus more nearly approximates the annual average than do prices based on arithmetical averages of monthly quotations.**

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

"Liquid Manure Pumps and Equipment," Agr. Ext. Serv., Univ. of Calif., Berkeley, Calif., Cir. 140, Sept. 1947, John B. Dobie.

"The Essential Elements for Plant Growth," Agr. Exp. Sta., Colo. A & M, Fort Collins, Colo., Paper No. 377, Robert Gardner.

"Analyses of Official Fertilizer Samples," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., Reg. Bul. 60, Oct. 1947.

"Data Relative to Fertilizer Consumption in North Carolina During the Fiscal Year July 1, 1946–June 30, 1947," Dept. of Agr., Raleigh, N. C., Nov. 4, 1947.

"Fertilizer Sales in Oklahoma by Counties, July 1, 1946 to June 30, 1947," Agr. Exp. Sta., Stillwater, Okla.

"Inspection of Feeds and Fertilizers," Agr. Exp. Sta., R. I. State College, Kingston, R. I., Annual Feed and Fertilizer Circular, April 1947, Roland W. Gilbert.

"Inspection and Analysis of Commercial Fertilizers," Agr. Exp. Sta., Clemson Agr. College, Clemson, S. C., Bul. 369, Nov. 1947, B. D. Cloaninger.

"Fertilizing Texas Pastures," Agr. Ext. Serv., Texas A & M, College Station, Texas, B-147, 1947, M. K. Thornton and Robert R. Lancaster.

"Distribution of Fertilizer Sales in Texas January 1–June 30, 1947," Agr. Exp. Sta., Texas A & M, College Station, Texas, P. R. 1091, Sept. 19, 1947, J. F. Fudge.

"Fertilizer Sales by Grades in Order of Tonnage July 1, 1947 thru December 31, 1947," Dept. of Agr., Richmond, Va., Feb. 10, 1948.

"1947 Results of Fertilizer Demonstrations on Small Grain and Hay," Dept. of Soils, Univ. of Wis., Madison, Wis., C. J. Chapman.

Soils

"The Agricultural Use of Peat Materials," Dominion Dept. of Agr., Ottawa, Canada, Publ. No. 803, Farmers Bul. 147, Nov. 1947, A. A. Swinnerton and P. O. Ripley.

"Soil Survey of Shefford, Brome and Missisquoi Counties in the Province of Quebec," Exp. Farms Serv., Dominion Dept. of Agr., Ottawa, Canada, 1947, D. B. Cann, P. Lajoie, and P. C. Stobbe.

"Let's Save Our Soil," Agr. Exp. Sta., Iowa State College, Ames, Iowa, Iowa Youth Series 1, Aug. 1947, J. B. Peterson.

"4-H and Adult Soil and Water Conservation," Ext. Serv., Okla. A & M College, Stillwater, Okla., Cir. 413.

"Your Three Acres—Conserve, Improve and Prosper With the Soil," Ext. Serv., Okla. A & M College, Stillwater, Okla., Cir. 476.

"Nitrification Capacities of Texas Soil Types and Factors which Affect Nitrification," Agr. Exp. Sta., Texas A & M College, College Station, Texas, Bul. No. 693, Sept. 1947, G. S. Fraps and A. J. Sterges.

"The Culinary Qualities and Nutritive Values of Potatoes Grown Upon Dry and Irrigated Land," Agr. Exp. Sta., Univ. of Wyo., Laramie, Wyo., Bul. No. 280, July 1947, Emma J. Thiessen.

"Report of the Chief of the Soil Conservation Service, 1947," U.S.D.A., Washington, D. C.

Crops

"On Alabama Farms in 1946," Agr. Ext. Serv., Ala. Polytechnic Institute, Auburn, Ala., 1946 Annual Report.

"Arizona Agriculture, 1948," Agr. Exp. Sta., Univ. of Ariz., Tucson, Ariz., Bul. 211, Jan. 1948, George W. Barr.

"Production of the Globe Artichoke in California," Agr. Ext. Serv., Univ. of Calif., Berkeley, Calif., Cir. 76, Rev. Oct. 1947, A. A. Tavernetti.

"Asparagus Production in California," Agr. Ext. Serv., Univ. of Calif., Berkeley, Calif., Cir. 91, Rev. Sept. 1947, G. C. Hanna.

"Home Fruit Growing in California," Agr. Ext. Serv., Univ. of Calif., Berkeley, Calif., Cir. 117, Rev. Sept. 1947, W. L. Howard, (Rev. by Reid M. Brooks).

"Improving California Brush Ranges," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., Cir. 371, Aug. 1947, R. Merton Love and Burle J. Jones.

"Growing Better Fruit in Colorado," Ext. Serv., Colo. A & M College, Fort Collins, Colo., Bul. 396-A, April 1947, F. M. Green and A. M. Binkley.

"Annual Report, 1946–1947," State Board of Agr., Dover, Del., Vol. 37, No. 3, June 30, 1947.

"Annual Flowers," Agr. Ext. Serv., Gaines-

ville, Fla., Bul. 133, Oct. 1947, John V. Watkins.

"Fifty-ninth Annual Report, July 1, 1946 to June 30, 1947," Ga. Exp. Sta., Univ. System of Ga., Experiment, Ga.

"1947 Progress Report on Corn Varieties and Hybrid Tests," Ga. Exp. Sta., Experiment, Ga., Cir. 154, Jan. 1948, G. A. Lebedeff and Orien L. Brooks.

"Agricultural Research in Idaho—Fifty-fourth Annual Report of the Idaho Agricultural Experiment Station for the Year Ending June 30, 1947," Agr. Exp. Sta., Univ. of Idaho, Moscow, Idaho, Bul. No. 269, July 1947.

"Growing Bush Fruits in Kansas," Agr. Exp. Sta., Kans. State College, Manhattan, Kans., Cir. 239 (Cir. 204 rev.), April 1947, G. A. Filinger.

"Vegetable Varieties for Kansas," Agr. Ext. Serv., Kans. State College, Manhattan, Kans., Cir. 194, 1947.

"How to Make and Keep a Good Lawn," Ext. Serv., Univ. of Maine, Orono, Maine., Ext. Bul. 349, Jan. 1947, Roger Clapp and George P. Steinbauer.

"Hardy Stocks in the Apple Orchard," Ext. Serv., Univ. of Maine, Orono, Maine, Bul. 355, May 1947, J. H. Waring and M. T. Hilborn.

"Better Home Grounds," Ext. Serv., Univ. of Maine, Orono, Maine, Bul. 359, May 1947, Albert D. Nutting and Roger Clapp.

"Soybeans for Minnesota," Agr. Ext. Serv., Univ. of Minn., St. Paul 1, Minn., Ext. Bul. 134, Rev. March 1947, M. L. Armour and J. W. Lambert.

"Sweetpotato Varieties," Agr. Exp. Sta., Miss. State College, State College, Miss., Info. Sheet 394, July 1947, W. S. Anderson.

"Dewberry Varieties at State College," Agr. Exp. Sta., Miss. State College, State College, Miss., Info. Sheet 395, July 1947, J. P. Overcash.

"Red Clover," Agr. Ext. Serv., Univ. of Mo., Columbia, Mo., Cir. 548, Aug. 1947, J. Ross Fleetwood.

"Shade Trees for the Home Lawn," Agr. Ext. Serv., Cornell Univ., Ithaca, N. Y., Ext. Bul. 724, July 1947, Donald J. Bushey.

"Chemical Composition and Freezing Adaptability of Strawberries," Agr. Exp. Sta., Cornell Univ., Geneva, N. Y., Bul. No. 726, Aug. 1947, W. B. Robinson, F. A. Lee, G. L. Slate, and C. S. Pederson.

"Cover Crop and Sod Plus Mulch Orchard Soil Management," Agr. Exp. Sta., Wooster, Ohio, Bul. 672, Nov. 1947, C. W. Ellenwood and T. E. Fowler.

Economics

"Statistical Supplement to the Canning Tomato Situation in California, 1947," Agr. Exp. Sta., Univ. of Calif., Berkeley, Calif., March 1947, Walter D. Fisher.

"Land Settlement in Northeastern Alberta, 1943," Marketing Serv., Econ. Div., Dominion Dept. of Agr., Ottawa, Can., Publ. 800, Tech. Bul. 63, Sept. 1947, B. H. Kristjanson and C. C. Spence.

"Kansas Farm Management, Summary & Analysis, 1946," Kans. Agr. Exp. Sta., Manhattan, Kans., Agr. Econ. Rpt. No. 32.

"Suggested Adjustments in Kansas Agriculture for 1948," Kans. Agr. Exp. Sta., Manhattan, Kans., Agr. Econ. Rept. No. 33, Aug. 1947.

"Mobility of Rural Population, A Study of Changes in Residence and Occupation in Two Types of Rural Communities," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., Bul. 505, June 1947, Howard W. Beers.

"Farms and Forests of Eastern Kentucky in Relation to Population and Income, An Appraisal of Population and Land Resources and Their Potentials," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., Bul. 507, Aug. 1947, Wm. A. Duerr, John H. Bondurant, W. D. Nicholls, Howard W. Beers, R. O. Gustafson, and John B. Roberts.

"Labor Efficiency in Harvesting Hay," Agr. Exp. Sta., Univ. of Maine, Orono, Maine, Bul. 453, Aug. 1947, George F. Dow.

"The Grain Storage Situation in Michigan," Agr. Exp. Sta., Mich. State College, East Lansing, Mich., Spec. Bul. 343, Sept. 1947, G. N. Motts.

"This Is Your Extension Service," Agr. Ext. Serv., Cornell Univ., Ithaca, N. Y., Ext. Bul. 725, Aug. 1947.

"1946 Acreage Yield and Production Price, Vegetables, New York and Competing Areas," Dept. of Agr. Econ., Cornell Univ., Ithaca, N. Y., A. E. 582, April 1947, M. C. Bond, Theresa Rinkcas, and Ruth Hampton.

"Marketing Fruits and Vegetables in Oklahoma," Ext. Serv., Okla. A & M College, Stillwater, Okla., Cir. 463.

"Keep Up Production and Save Grain," Ext. Serv., Okla. A & M College, Stillwater Okla. Cir. 467.

Ground Cover

(*From page* 26)

Grass mixed with alfalfa also reduces the danger of bloat when grazed by livestock. In the lower South where orchard grass is not grown extensively, the new fescue grasses are promising for use with alfalfa.

On class III land, short rotations such as the one used at Watkinsville are

more effective if arranged in strips on the contour. Even on terraced fields, a strip arrangement increases the protectiveness of the rotation by keeping the entire fields from being plowed at any one time, by bringing storm water under control and reducing erosion damage when terraces overtop or break, and by helping to keep plowing, harrowing, and seeding operations near the contour.

Class IV Land

Because of slope, erosion, and other conditions, land in capability class IV is better suited to pasture or a similar use than to cultivation. Farm machinery cannot be operated as efficiently on the steeper slopes of this class as on the smoother land in other cultivated classes. Acre yields of most crops are lower on the eroded soils of this class than on the better cultivated land.

Sometimes, however, there is not enough land in the other cultivated classes to meet the needs of the farm. Class IV land can be cultivated occasionally if effective cover is maintained the rest of the time.

Kudzu has been a highly effective cover on land of this class at Watkinsville. The dense top growth, deep roots, and the heavy mulch of leaves and stems combine to make kudzu almost ideal ground cover for steep slopes. Both soil and water losses at Watkinsville have been very low from class IV land that had a heavy cover of kudzu.

Runoff plots on which kudzu is growing are plowed every third year and planted to corn. Soil and water losses during the year under cultivation have been surprisingly low. The heavy residue of leaves, stems, and kudzu roots gives effective protection while the corn is growing and enough plants survive to restore ground cover before frost kills the kudzu in the fall.

Studies are under way at Watkinsville to learn how to use kudzu practicably in rotations. Results to date show that kudzu will stand considerable cultivation without being eradicated. Successive crops of corn, cotton, and oats left enough living plants to cover the ground in the fall after the oats crop was harvested.

Sericea lespedeza is another deep-rooted perennial legume that protects class IV land from erosion after a thick stand is established, and fits well into crop rotations. Sericea can be plowed up for a cultivated crop, which can be followed by small grain, once in four years. In rotations at Watkinsville, sericea was reseeded after oats were harvested.

Grass and clover mixtures that are managed so as to keep the land well protected can be used in rotations on class IV land. The vigorous fescues that are showing so much promise in the South may give us better grasses for use in mixtures on this class of land. They have shown much promise on land that was too steep and eroded for most other grasses. Rotation studies with fescue were started at Watkinsville in the fall of 1947.

A strip arrangement on the contour is needed on class IV land. This is particularly true on slopes that cannot be terraced satisfactorily. It is again emphasized here that land in this class is better suited to uses other than the production of cultivated crops and that where cultivation is necessary, the most effective types of ground cover are essential.

Up to this point, we have talked about use and treatment of land on which erosion is a factor. Let's consider the sub-classes of land that require drainage to remove excess water. These will be considered as a group.

Even though erosion is not a factor, land in the drainage group needs ground cover to supply organic matter and to maintain favorable soil structure. We know a great deal more about the kinds and amounts of cover required to control erosion on sloping uplands than we do about the ground cover needs of lowlands that require drainage. It is logical though that

covers similar to those discussed for land in capability class I will be needed to maintain good physical condition and a high level of productivity. Good physical condition of heavy clays that are drained and cultivated is essential to the effectiveness of drainage ditches and tile lines.

Some of the deep sandy soils are over-drained. They absorb water so readily that erosion is not usually a serious problem. They do not need ground cover to protect them from erosion, but plant covers to maintain a supply of organic matter are essential. Ground cover helps to conserve these sandy lands internally, rather than protect them from erosion.

Other factors besides vegetation are important in the conservation of cultivated land. Modern equipment enables farmers to produce more small grain and hay crops than were feasible before adapted machinery was available. This is especially true of equipment that can be used on sloping land.

Like many other improvements, mechanized farming brings new problems. Farmers who disregard slope of the land and operate breaking plows, harrows, and grain drills up and down hill cause severe erosion. Manufacturers of farm machinery recognize this and they are emphasizing the importance of operating equipment on the contour.

Ground cover can do much to make terracing, contour tillage, and other mechanical measures more effective in erosion control. Important as it is, however, ground cover cannot prevent erosion where plowing, harrowing, seeding and cultivation are up and down slopes. There must be a proper combination of mechanical measures and vegetation if erosion losses are to be kept low on cultivated land. Neither mechanical measures nor ground cover alone can do the job. Both are needed.

Soil treatment is another factor that cannot be overlooked if ground cover is to do all that has been discussed in preceding paragraphs. Plants can give effective cover and produce large yields only if they are fed. Most of the soils in the South require applications of lime, phosphate, and potash for vigorous growth of the legumes required in ground covers.

Southern agriculture was developed around cash crops so that most of the income was from the cultivated land. Under such a system, the land in classes discussed up to this point was about all that received attention. In making a complete farm soil and water conservation plan, however, all land is planned for the use to which it is best suited. This type of planning brings other kinds of land into productive use. Let us now consider the use and treatment of some of these other lands.

As has been said already, class IV land is cultivated only when conditions on the farm make such use necessary. This class of land is much better suited for grazing than for cultivation. A well-treated pasture sod or a deep-rooted perennial legume that will furnish grazing for livestock is the ideal use for land in this class.

Class V Land

Class V land is flat enough that erosion is not a factor in its use. This class of land is either poorly drained or underlain by rock so that it is not suited for cultivation. It need not be waste land, however. Land that is placed in this class because of unfavorable drainage conditions often is the best adapted pasture land on the farm. Surface drainage to remove excess water, liming, fertilizing, soil preparation, and seeding to a grass and clover mixture often convert such land into some of the most productive on the farm.

Areas of wet land adjoining cultivated fields frequently have remained idle because it was not feasible to fence them. Introduction of the tall fescues into the South has opened possibilities for seeding these wet areas to fescue and either Ladino clover or white clover and using them for winter grazing when livestock glean the cropland.

Natural depressions into which water from terrace ends is emptied often are too wet for most of the forage plants that are commonly planted. Fescue is adapted to these wet sites and may be used as protective vegetation in water disposal and as a reserve of winter feed. Fortunately, fescue makes a turf that will support animals, even on wet lands.

Class VI Land

Class VI is steep land which has suffered a moderate amount of erosion. It is entirely too steep for safe cultivation or for the economical operation of farm machinery, but it is good land if used and treated properly. Land in this class requires continuous cover to prevent destructive erosion.

A well-treated pasture sod or a deep-rooted perennial legume such as kudzu or sericea lespedeza is suitable cover. Where the protective ground cover is to be pastured, management must be such as to keep the ground well covered at all times. Extremely close grazing, lack of lime and fertilizer, or any other bad management practice that results in poor cover will lead to severe erosion on this class of land.

New developments in the use of land on which kudzu and sericea are grown for grazing are worth mentioning here. Winter crops seeded over these summer perennials offer much promise of increasing soil protection, the amount of feed, and the length of time grazing is available. Wild winter peas and crimson clover have been overseeded successfully on both kudzu and sericea. Fall grazing of the summer perennials is necessary to give the winter plants a start.

Kentucky 31 fescue was seeded on several sericea pastures in the Soil Conservation Service's Land Utilizaiton Project at Dalton, Georgia, in the fall of 1947. Good stands of grass came up and it is hoped that fescue may grow in a mixture with sericea. Robert M. Newman, a dairy farmer at Huntsville, Alabama, sowed sericea and fescue together in the spring of 1947. He pastured dairy cows on it in the summer and a fair stand of both grass and sericea was present in October. These seedings are mentioned here to show some of the possibilities for using more profitably some of the steeper uplands that once were considered suitable only for woodland.

Where wild winter peas are sown on kudzu, oats also may be sown once every 2 or 3 years and used for winter grazing. Where this practice was used at Watkinsville in the fall of 1946, light grazing was available from volunteer oats and peas in December of 1947.

Another distinct advantage to seeding winter crops on land where kudzu or sericea is grown is that these areas can be grazed safely during the winter when continuous rain for several days gets cropland too wet for animals to graze. Firm ground on such areas gives good footing for animals when cropland is so wet they will mire.

Class VII Land

Class VII is steep land that already has suffered severe erosion. It is unsuited for cultivation and is best adapted for woodland use. In certain cases where the acreage of other grazing land on a farm is limited, class VII land may be used for grazing. On soils with absorptive subsoils where kudzu is adapted, this legume when properly treated gives sufficient protection to prevent erosion and to supply grazing for livestock. Sericea will protect land of this class after a good stand is established. Special practices such as light mulching may be necessary to get a stand of sericea on class VII land.

Where land in this class is used for grazing, good management to keep the ground well covered at all times is absolutely essential. Failure to keep the ground covered will result in destructive erosion.

Where steep, eroded land is not required for grazing, woodland is its best and safest use. Proper woodland management, including protection from grazing and fire and the use of good

harvesting methods to keep the ground well covered, is essential. Good management protects the land from further destructive erosion and maintains the woodland in condition for a high level of timber production.

Class VIII Land

Class VIII is either too stony or too wet for cropland, pasture, or woodland use and is suited only for recreation or wildlife. Usually there is not enough of this land to be of any importance. Most farms have other land that can be used to advantage for recreation and wildlife purposes.

Recreation is essential to a well-rounded life for farm people. Wildlife produces wholesome recreation, adds variety to the diet of the farm family, and adds to the control of insect pests. Ground cover provides food and cover for small animals, game birds, and songbirds so that their numbers are maintained at normal levels.

Small, odd-shaped areas that are not suitable for cropland, grazing land, or woodland often are ideal for wildlife, if covered with appropriate types of vegetation. Natural growth of shrubs and plantings of bicolor lespedeza protect these areas from erosion and add to their value for wildlife.

Borders between cultivated fields and woodlands usually have been waste areas on which crops would not grow. These border areas were plowed and planted along with the rest of the field, and erosion often was severe. Strips of bicolor lespedeza next to the woods with sericea next to the cultivated land protect borders from erosion and furnish food and cover for wildlife.

When compared with what is common practice in the South, the recommendations for ground cover on the different classes of land may appear somewhat extreme. We have evidence, however, that the land needs about the kinds and amounts of cover recommended to protect it from destructive erosion and to build and maintain a profitable level of productivity.

Agricultural Reforms Needed

Ground covers required in a well-planned and applied program of soil and water conservation, based on the capabilities and the needs of the land, would go far toward bringing to pass many of the agricultural reforms that long have been advocated in the South.

Larger acre yields have been emphasized by practically all leaders in Southern agriculture. Rotations suggested here for cropland include legumes and crop residues to manure the land and make it produce larger acre yields while reducing erosion, improving soil structure, and doing other things required in soil and water conservation.

More and better livestock to give a balanced income of crops and animal products, together with more even distribution of farm labor, also has been emphasized as an outstanding need in the South.

Increased production of grain through larger acre yields of corn, and small grain, and grain sorghum grown in soil-conserving rotations would mean more feed for livestock. Likewise, forage from steep slopes and wet lands that are not now in profitable use, and from protective ground covers included in rotations, would make livestock production on average crop farms a feasible enterprise.

When we use all available land and plant resources according to their capabilities, the South can continue to produce cash crops and also furnish her share of the Nation's market livestock products. If we do this, we shall have a sounder agriculture and a more prosperous farm population. These changes in agriculture will be reflected in a more diversified Southern industry. These desired ends can be reached only through on-the-ground planning for the use of all our resources.

Radioisotopes

(*From page* 18)

Cornell Stations, new projects will be centered at the Ames, Iowa, and the Ft. Collins, Colorado, Stations. Radiophosphorus is also being used at the Ohio, Connecticut, Florida, California, Iowa, and many other Stations in this country and in Canada.

Radiocalcium

At the Cornell Station Dr. Michael Peech and associates are using radiocalcium to study the lime problems of soils. The purpose is to find out how lime benefits plant growth on acid soils and to determine the most efficient method of liming soils. Preliminary results indicate that the poor growth of many crops on acid soils is not necessarily due to the low supply of calcium. For some reason not yet understood, plants are unable to absorb calcium from acid soils even when well supplied with soluble calcium salts.

Radiocobalt and Radiocopper

Dr. George K. Davis and Dr. C. L. Comar of the Florida Agricultural Experiment Station have reported on mineral metabolism studies of farm animals under natural conditions. The cobalt requirement and its retention in animal tissues being very small, it has not been practicable to use chemical and physical methods of analysis to solve the problems. The tracer technique has been used quite successfully to acquire fundamental information on minor element metabolism. In Hawaii

Photo by U. S. Army Signal Corps

Fig. 10. Highly active materials from the pile are taken to special "hot" laboratories for extraction of the desired pure isotopes. Here is the start of an operation in a "hot" laboratory. Paul Schallert, working rapidly with very long-handled tongs, introduces the active material through the roof of a special heavy concrete-walled small room or cubicle. The material drops down inside the cubicle to chemical processing units which can be operated completely and safely from outside the cubicle.

Photo by U. S. Army Signal Corps

Fig. 11. Health physicist checks a radioisotope in a shipping container.

radiocobalt is being used to trace the feeding habits of insects upon plants.

Radiopotassium

Normal potassium contains two stable isotopes, K39 and K41. The K41 isotope makes up only 6.61 per cent, while K39 comprises 93.35 per cent of the total amount of these two isotopes. Besides these stable isotopes, there occurs a radioactive isotope K40, present in the small amount of 0.012 per cent. K40 has a half-life of 10^9 years which means that it is of too low an intensity to be useful in tracer research.

The only isotope of potassium which can be used as a tracer is K42. It has a half-life of 12.4 hours and emits very high energy negative beta particles. Radioactive K42 is produced in the uranium pile at Oak Ridge.

The U. S. Department of Agriculture laboratories at Beltsville, Maryland, are using K42 in research work with hormones and in the study of soils. However, because of its brief half-life its usefulness as a tracer is limited.

Radiosulfur

Sulfur and sulfur compounds are now receiving the consideration of agricultural workers which they deserve. S^{35} has been investigated extensively by Dr. M. D. Thomas of the American Smelting and Refining Company laboratories in Utah. Working with wheat, corn, sugar beets, and tomatoes Dr. Thomas has studied by means of the tracer technique and the radioautograph the rate of absorption, translocation, and conversion of sulfur into organic form. He has also reported on his excellent studies with radioarsenic As^{76}.

Radiosulfur is being used at the University of California in studies on the synthesis of sulfur-containing protein materials by plant life. Also at this Station radiosulfur is helping in the study of insecticides and fungicides for the purpose of reducing plant injury. It is estimated that in this country more than 500 million pounds of sulfur are used annually to control insects and disease of plants.

Other radioisotopes

Radiozinc, radiochlorine, and radioiodine are adding to our knowledge of hormone chemistry in plants.

At the State College of Washington, Pullman, Dr. Orlin Biddulph has been using radiophosphorus and radioiron in a comprehensive study on the incidence and cure of chlorosis in plants. He already has reported positive results on some interesting relationships between phosphorus uptake and iron in the soil. Chlorosis in the sugar cane is being studied with radioisotopes in Hawaii.

The number and variety of agricultural research projects involving the use of radioactive isotopes are increasing rapidly. These projects involve problems in biology, chemistry, physiology, pathology, insecticides, fungicides, and plant nutrients. The work has only just begun, but the remarkable results which already have been reported kindle the imagination and stimulate the efforts of the scientists. Thanks to the generous support of the Atomic Energy Commission which is making radioisotopes available to research workers in all branches of science, the tracer technique can be expected to prove one of the most effective tools of research ever devised.

Hitting the Target

(*From page* 22)

corn will grow fast, furnish an abundance of shade, and keep the field surprisingly free of grass and weeds.

Other Side-line Facts about Corn

Fertilizer costs. At the present price of fertilizers, the cash cost per acre will range from $18 to $22 per acre when 6 tons of barnyard manure are used, and from $28 to $32 per acre when all the nutrients are from chemical fertilizers. The Mississippi average corn production per acre is from 16 to 20 bushels, consequently one would spend approximately the above amounts for fertilizers to be used on 5 or 6 acres under ordinary fertilization practices. If the same amount of corn can be produced on one acre, and it can be done, then would it not be to the farmer's advantage to do this and put the other 3, 4, or 5 acres to a better use?

Planting date. The corn was planted in May and June, with a few acres planted in July. As previously stated, the drought caught it in the most critical stage. Our late planting was due primarily to the extremely late spring and continuous wet weather until in May. We believe that the corn following this plan of fertilization has a much better chance to withstand the midsummer drought than corn under ordinary farm practices; and we likewise believe that earlier planted corn (any time after the soil warms up, probably somewhere around April 5 to 20) will have even a greater chance at high production because it will be well on its way to being made when the midsummer dry weather sets in.

Labor. Even with thorough land preparation and putting the fertilizers 8 inches deep, the labor for an acre of the 100-bushel corn will be no more, and in most cases even less, than for an acre following ordinary practices. A minimum amount of cultivation, plus the fact that no thinning or hoeing is necessary, makes this an additional strong point for the plan to most farmers. Considering that 5 acres of ordinary corn make 100 bushels, or 20 bushels per acre, the labor cost is about one-fifth as much on the one acre which

Fig. 4. The yield-estimating contest on the R. B. Caldwell farm, Caledonia, Mississippi.

makes 100 bushels as it is on the five which make same amount.

Value in dollars and cents. The average cost of fertilizer for participants in this demonstration program was $26 per acre; cost of seed corn was $1.25 per acre—a total cash cost for seed and fertilizer of $27.25. As stated above, the average production per acre was 79.6 bushels. This amount of corn at present market price ($2.30½ at Chicago) is worth $183.48. Returns above the cost of seed and fertilizer were $156.23.

Fig. 5. A side view of Mr. Caldwell's field where 450 farmers, Veterans, boys, and girls attended the all-day estimation contest.

TABLE 2.—WINNERS IN THE PRODUCTION CONTEST WITH AMOUNTS OF FERTILIZERS USED, FERTILIZER AND SEED COSTS, YIELDS, AND RETURNS ABOVE COSTS

Name	Fertilizers used*	Cost of seed and fert.	Yield per acre	Returns above cost of seed and fert.**
R. B. Caldwell (N. C. Plan followed on this same acre in 1946)	500# 4–8–8 200# ammonium nitrate 400# basic slag 100# muriate of potash Good cover crop	22.65	108.5 bushels	$227.54
Gregory Duncan	1,000# basic slag 100# muriate of potash 600# superphosphate 200# ammonium nitrate Cover crop 6 tons barnyard manure	23.15	104.1 bushels	$214.80
Roy Jones (Creek bottom soil)	300# superphosphate 200# muriate of potash 950# nitrate of soda	35.40	144.4 bushels	$297.44
Dan and Emmett Lagrone	500# 4–8–8 300# ammonium nitrate 7 tons manure Good cover crop	20.25	126.9 bushels	$277.92
Raymond and Sid Murphy	800# 5–10–5 200# ammonium nitrate 6 tons manure	23.25	106.3 bushels	$221.77
J. M. Sharp	600# 5–10–5 80# superphosphate 100# ammonium nitrate 150# nitrate of soda 4 tons manure	21.07	106.2 bushels	$223.72
Leo Wright	1,000# 6–8–4 1,000# basic slag 250# ammonium nitrate 200# potash 10 tons manure Excellent cover crop	40.75	110.5 bushels	$219.69
Mississippi average		$3.25	16.0 bushels	$33.63
Av. of participants in plan		$27.25	79.6 bushels	$156.23
Av. of winners-listed above		$27.07	113.8 bushels	$235.24

* No cost figured on cover crops and manure; ammonium nitrate $60 per ton; potash $60; nitrate of soda $52; superphospate $23; slag $12; commercial fertilizer $40; 5 qts. Tenn-10 seed corn at $1.25.
** Corn figured at $2.30½ per bushel—Nov. 6, 1947, Chicago market quotation.

For an average ace of corn in the Caledonia community the yield would run around 21 bushels per acre, the fertilizer costs would be about $4 per acre, and the seed would cost about 40 cents. Twenty-one bushels of corn at present market price are worth $48.40. Returns above cost of seed and fertilizer are $44. Thus, we can see that an additional investment of $22.85 in seed and fertilizer would be worth $112.23 or approximately 500 per cent returns.

For another comparison, let us take

a look at the seven highest producers in this plan. (See Table 2) Their average yield was 113.8 bushels per acre with a value $262.30. The average cost of seed and fertilizers for these seven producers was $27.07 per acre, not including cost of manure and cover crops. This gives a return above cost of seed and fertilizer of $235.24 per acre.

From the time the corn was knee-high until the time that it was ready for harvest, between 1,600 and 2,000 people visited and studied many of these plots. Some of these groups were: Sixteen veteran on-the-farm classes, soil conservation officials from five counties, six FFA chapters, fertilizer people, Columbus Chamber of Commerce, various farmer and business men groups, agricultural leaders and workers, and some 600 local farmers. In August, this special plan was presented to the state conference of vocational agriculture teachers and veterans instructors at Gulfport, Mississippi, with some 300 present.

On October 24, 1947, an all-day estimation contest was held on the farm of Mr. Caldwell. From 9:00 a. m. to 4:00 p. m., farmers, ladies, boys, and girls came by and turned in what they thought the acre of corn would produce. Prizes of $265 were donated by business firms and merchants of Columbus, Caledonia, Steens, and Kolola Springs. Three hundred sixty-eight estimates were recorded and some 100 other people came by but did not guess at the corn. Production prizes were awarded in the field and the winners were taken to the studio of radio station WCBI, Columbus, Mississippi, and made a 15-minute recording. This was broadcast the following morning.

The Future

We would hesitate to state what will be the widespread effect of this work throughout Mississippi. The local papers, Memphis and Jackson papers, farm magazines, radio, and individuals have told the story. However, here at home, we believe that we can make a reliable prediction for our community for 1948. Here it is: 1946—1 acre; 1947—70 acres; 1948—400 acres.

Peanut Land and What It Needs

(*From page* 9)

help to maintain and improve soil productivity.

In a conservation cropping system of vetch and rye following peanuts on these deep, coarse, sandy soils, fertilizers applied at the rate of 200 to 300 pounds of 0-14-7 plus 6 to 8 pounds of nitrogen under the legume have resulted in increased yields of peanuts from 30 per cent to sometimes as high as 100 per cent.

Hairy vetch and rye used as a green manure soil-improving crop in the Cross Timbers not only hold the soil in place and increase the organic matter, but help make plant foods available to plants. Managing the crop residues so that as much plant litter, stalks, and stems as possible will remain at the surface of the soil is an important wind-erosion control practice in the Cross Timbers. After sorghums are combined, good wind-erosion control can be obtained by using a stalk cutter and then harrowing the fields to leave a trashy mulch at the surface.

In areas of deep sandy soils in warm climates, organic residues decompose rapidly. That forces us to give measures which maintain or improve the organic matter major consideration in soil and moisture conservation programs. Organic matter is of use mainly while it is decaying or being destroyed. It is while this process is going on that it makes available nitrogen and minerals

Soil Conservation Service Photo

Fig. 6. Peanuts in the bags and peanut hay stacked under the wagon sheet mean that a lot of plant food is moving off this field. Many soil-improvement measures will be required to offset the effect of removing the peanuts and hay.

needed by growing plants. Obviously, organic matter lost by decomposition needs to be replaced in the soil.

Research shows that a crop of hairy vetch which yields about a ton of dry matter an acre will add about 1,000 pounds of vegetal matter to the soil. However, these 1,000 pounds stay in the soil as a part of the humus only a limited time.

Continuous cropping with peanuts when all the plant, below and above ground, is carted off in the harvest therefore tends to lower the soil's organic matter content, reduce the productive capacity, and make the land susceptible to blowing. Some part of the crop ought to be left so that succeeding crops will have plant food to draw upon.

Weed 'Em for Freedom

(*From page* 5)

Another way to visualize the extent of the surging movement gardenward in recent years is to note the increase in the percentage of commercial fertilizers which have been devoted to fresh vegetable culture. In 1929 it is said that 5.3 per cent of the 5.5 million tons of fertilizer went on vegetable crops. In 1946 this had increased to 10.5 per cent of about 15 million tons utilized. The motive animating these enthusiastic garden builders lies in thrift or a clubby feeling with neighboring suburbanites, or both. If the average sum total of cash-in-hand saved through raising succulent green foods in season amounts to less than $75, as some claim, then only the ones on very low incomes and with big families may be said to feel the urge mainly for financial reasons.

It is probable that householders who need gardens mostly through financial reasons are themselves situated in residential districts at some distance from good available garden grounds. In such cases their transportation would be a factor to subtract from net sav-

ings. Yet here it seems to me that we have evidence that folks will travel a good long way from home, if necessary, just to get their fingers into the soil and imbibe the fresh air, and get that chummy and competitive feeling which all community garden projects usually engender.

Two seasons ago I attempted to grow a kitchen garden on a soggy clay loam hillside overlooking a broad, primary river of historic note. On one side of my plot was another one in charge of a Navy officer. Behind me to the left was a sizable fenced-in area where the janitor of an apartment house spent spare hours. To the right and rear a retired bridge-worker created a veritable Eden of edibles. This man had never touched a garden hoe and rake before, but he possessed some extraordinary judgment and ability, together with the knack for mechanical precision learned at his exacting job. We all wound up by purchasing some of his choice sweet potatoes and cabbage. We couldn't trade him anything because he excelled in every vegetable known to the catalog.

Some of us grew so friendly that we held a harvest-time party late that fall and awarded the iron-worker who built the wartime bridge across our winding river with a leather medal, in token of his championship among the carrots.

DURING the late days of winter one's stock of patience and forbearance runs low and about the only literature that will pep up the old spirit are the gaudy seed catalogs. As one grows older his vivid interest in these pages packed with advice and tempting new varieties helps to make up for other shortages too frequent in the middle and elder years.

As purveyors of harmless but enthralling romance, our favorite authors include, among others, Vaughan, Henderson, Ferris, and Burpee, who stimulate our imagination, make heroes of the humblest citizen, excel in vivid description, and provide a stirring plot—even if it is only a small plot between the back steps and the garage doorway, with your humble servant doing most of the stirring.

I cannot say that in my youth these harbingers of promise excited me in the way they do today. My parents unwrapped them quickly and gloated over the lithographs and price lists, but my personal lack of responsibility for the season's sustenance and the lure of the swimming hole and the playground dimmed any enthusiasm which I should have inherited from a family of farm-bred producers.

Yet when it came to consuming my full share of the canned vegetables or eating luscious tomatoes and watermelons I was never devoid of eagerness and appetite. Doubtless I can attribute a lifetime fairly free of ailments to that judicious and discriminating perusal of seed catalogs on the part of my parents, whose annual garden was indeed a "freedom garden." They tended it themselves and gave me freedom to work up an appetite at sundry non-productive and carefree diversions.

All this occurred before scientific savants invented the vitamin alphabet, which is now learned in school before long division or the multiplication table. Nevertheless the vitamins got in their effective work just the same in the years of my indolent youth, for the sunshine and the rain were there and the sap flowed and the soil was rich, and osmosis and chlorophyl and protoplasm and photosynthesis stuck to their knitting—and I'm still on deck to praise nature for my comfort and well-being.

Now I know why I kept most of my health and as many teeth as I possess. I can read all about it now in the hefty textbooks and the lofty government bulletins, and I get instructions about what ails us when we don't eat right, together with special footnotes saying that it's cheaper and simpler to absorb our minerals and vitamins at a bal-

anced meal than it is to consult a drug clerk.

All this is just like going to war and being shot at and escaping scot-free of scars, without knowing the chemical composition of the gunpowder or the trajectory of the cannon they fired at you. One sure thing you realized, and that is the fact that the Creator gave mankind protective features and measures well within his reach, providing he has gumption enough to stir his blood with exercise, expose his skin to the sunshine, and take his medicine in generous doses of fresh garden produce.

But we don't get all this protection and verve for nothing. The insect and fungus worlds also appreciate the vitamins which exist in fresh vegetables and growing tissues. So it's always a keen and exciting race between us hopeful gardeners and the army of predatory creatures and viruses that come to lay constant claims on that private arbor of ours.

We've learned a heap in outwitting them since my early days with a whiskbroom and a pail of paris green, or a sprinkling of lime and ashes on suspicious varmints. The same scientific guys who helped discover the cute ways in which these bugs and larvae and slimy disease filaments take their fill of our vegetables are the ones who figured out innumerable terrifically long and double-jointed names for modern weapons with which to checkmate the horde of garden enemies. Why, actually, some of these proper names for chemical compounds and synthetic mixtures would use up a whole new typewriter ribbon, but I pay no mind to that drawback, invest my winter savings in them, and usually find them advantageous—if I get in there first and start shooting ahead of the vanguard of the scourge.

Possibly we are getting salvation and protection from our garden enemies a mite too fast in some ways. That is, we have to be careful with some of these newer concoctions that they don't carry a kick-back like Granddad's old shotgun, because what's hell for the pests may be a trifle devilish for us if we don't watch out. I am a firm follower of science, but I don't want to get the recipes applied in the wrong way. Of course, all this uncertainty makes the garden season more sprightly.

IT'S customary in all well-done articles intended to clinch and rivet something to fetch in a brace of statistics toward the end. (You seldom do it earlier so's the customers won't go to sleep and lose the place.) I turn with some regret, therefore, to a set of tables I purloined from a mess of material down in the Agriculture building, saving it all this time for a real treat for my chums.

It seems the University of Tennessee and the Bureau of Home Economics in Washington laid their heads together and totaled up some digits they dug up in a survey in 1944 made all over the home state of James K. Polk and Andy Jackson. Believe it or not, it's your privilege, these surveyors covered households in 17 counties, and specialized finally in Blount county. What they discovered as to the amounts of boughten and home-raised food used by these Tennessee folks is going to go down with you much better handled this way than if I had begun this in statistical style.

The average farm family produced two-thirds of the food that went into the meals served at an average value of $407 per family, while the rural non-farm families in Blount county raised one-eighth of the food served with an average value of $99.

Beef and dairy products ranked first with the Tennessee farm families in their home production, while meat and eggs account for the top lines raised at home by non-farm families studied.

Among the non-farm families the amount and value of the home-supplied food declined as the income level rose. Some of the low-income non-farm families had little or no employment and

hence probably had more time for food production than did the ones with high incomes. Expenditures for food in this group tended to rise more rapidly with a rise in income than it did with strictly farm families.

Now for vegetables and fruit as a separate class, just with the non-farm families in rural areas of Blount county. At an average income of less than $1,000, nearly 70 per cent of the units raised vegetables and fruit at home at a value of about $15; at income levels between $2,000 and $3,000 per family, 69 per cent of them did so at a value of about $11.50; at income levels between $4,000 and $5,000, 57 per cent raised these products at a value averaging about $6.

But with all Tennessee white farm families of two or more persons, the study showed no income level group which did not raise vegetables and fruit about 100 per cent at an average comparable cash value of nearly $55 per family. This was out of a total value of all home-raised food equal to about $410 each.

In contrast, 70 per cent of all white non-farm rural families had average home-raised fruit and vegetable cash values of about $12 each, of a total value of all home-raised food equal to $100 apiece. There appears but small difference in the cash values of such truck raised at home by different tenure groups, although a bit in favor of the farm-owners.

Of course, cash values at the store four years ago were lower than the same amounts of fresh vegetable products would be worth now. If they had carried this study into Memphis and Nashville to find out how well the white collar gentry rate in the garden business, we could make out a better case for the man with the hoe.

But it's time to quit surveying and catalog scanning and start that seeding. It's the succotash that counts, not the statistics!

A Much-Needed Aid in Soil Testing

The New

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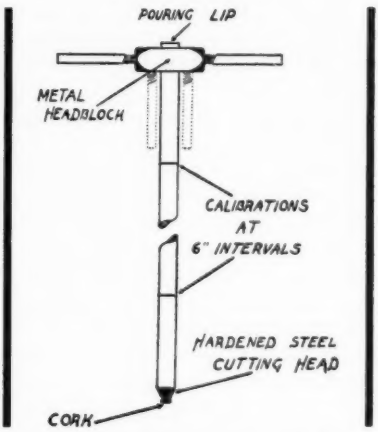
SOIL SAMPLING TUBE

(Hankinson-Hester Design)

Patent Applied for



This New Soil Sampling Tube has been designed by experts who have had extensive experience and who appreciate the difficulties encountered in taking true soil samples with the ordinary tools available heretofore.

The instrument is sturdily built of non-corrodible metals, light in weight (3½ lbs.), and calibrated in 6" intervals for accurate soil sampling to any depth to 3 ft. It is so designed that the entering soil core passes freely into the upper tube and upon inversion is discharged without "sticking." Plastic Vials (1¼" x 5⅞") with screw caps, for containing soil samples can also be supplied.

Write for descriptive literature.

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AVAILABLE LITERATURE

The following literature on the use of fertilizers in profitable soil and crop management is available for distribution. We shall be glad to send these upon request and in reasonable amounts as long as our supply lasts.

Circulars

Tomatoes (General)
Asparagus (General)
Vine Crops (General)
Sweet Potatoes (General)
Better Corn (Midwest) and (Northeast)
The Cow and Her Pasture (General)

Reprints

N-9 Problems of Feeding Cigarleaf Tobacco
F-3-40 When Fertilizing, Consider Plant-food Content of Crops
S-5-40 What Is the Matter with Your Soil?
II-12-42 Wartime Contribution of the American Potash Industry
J-2-43 Maintaining Fertility When Growing Peanuts
Y-5-43 Value & Limitations of Methods of Diagnosing Plant Nutrient Needs
FF-8-43 Potash for Citrus Crops in California
A-1-44 What's in That Fertilizer Bag?
H-2-44 Efficient Fertilizers for Potato Farms
AA-8-44 Florida Knows How to Fertilize Citrus
QQ-12-44 Leaf Analysis—A Guide to Better Crops
P-3-45 Balanced Fertility in the Orchard
Z-5-45 Alfalfa—the Aristocrat
DD-5-45 A Case of Combined Potassium and Boron Deficiencies in Grapes
GG-6-45 Know Your Soil
OO-8-45 Potash Fertilizers Are Needed on Many Midwestern Farms
TT-10-45 Kudzu Responds to Potash
ZZ-11-45 First Things First in Soil Fertility
CCC-12-45 Poor Soils—Poor People
H-2-46 Plow-sole Placed Plant Food for Better Crop Production
S-4-46 Plow-under Fertilizer Ups Corn Yields
T-4-46 Potash Losses on the Dairy Farm
W-4-46 Muck Soils Produce Quality Sweet Corn for Canning
Y-5-46 Learn Hunger Signs of Crops
AA-5-46 Efficient Fertilizers Needed for Profit in Cotton
BB-5-46 The Soil Is Our Heritage
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ZZ-12-46 Alfalfa—A Crop to Utilize the South's Resources
A-1-47 Fertilizing Vegetables by Applying Fertilizer to Preceding Cover Crop
B-1-47 The Use of Dipicrylamine in Tissue Testing for Potash
G-2-47 Research Points the Way for Higher Corn Yields in North Carolina
I-2-47 Fertilizers and Human Health
K-2-47 Potash Pays for Peas at Chehalis, Washington
M-3-47 The Role of Major Elements in Plant Nutrition
N-3-47 Efficient Management for Abundant Pastures
P-3-47 Year-round Grazing
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S-4-47 Rice Nutrition in Relation to Stem Rot of Rice
T-4-47 Fertilizer Practices for Profitable Tobacco
V-4-47 Don't Feed Alfalfa at the "Second Table"
X-5-47 Potato-growing Developments in New England
Y-5-47 Increasing Grain Production in Mississippi
Z-5-47 Building and Maintaining Good Lawns
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FF-6-47 Community Cooperation in Soil Conservation
GG-6-47 Corrective Measures for the Salinity Problem in Southwestern Soils
II-8-47 Whole-farm Demonstrations
JJ-8-47 Analyzing the Soils of Northwest Louisiana
KK-8-47 Minor Plant Nutrients
LL-8-47 Reshaping New England Farm Land
MM-8-47 Fertilizing Potatoes Economically in Aroostook County, Maine
NN-10-47 Let's Replace Guessing with Soil Testing
OO-10-47 From Broom Sedge to Beef Cattle
PP-10-47 Potash Fertilization of Alfalfa in Connecticut
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VV-11-47 Are You Pasture Conscious?
WW-11-47 At the Tip of the Shoot and the Point of the Root
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YY-11-47 Boron for Vermont Farms
ZZ-11-47 Some Things to Think About
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D-1-48 A Good Combination: Lespedeza Sericea and Crimson Clover

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THE AMERICAN POTASH INSTITUTE
1155 16TH STREET, N. W. WASHINGTON 6, D. C.

One Sunday morning a father met his four-year-old son, an ardent radio listener, just as he was coming out of Sunday School. The son was asked what the children had been doing. "Oh, they sang," he answered. "And what did they sing?" was the inquiry. "I don't know what they were singing," replied the lad, "but I sang 'One Meat Ball.'"

* * *

INJUSTICE

An old colored man was complaining about the railroad refusing to pay for his mule which had been killed by a train.

"Dey won't pay for mah mule. Dey won't even gimme back mah rope."

"What rope?" he was asked.

"Why, sah," he replied, "de rope ah done use to tie de mule on de track."

* * *

Overheard at the lunch counter: "Well—of course, I wouldn't say anything about her unless I could say something good. And, oh boy, is this good . . ."

* * *

Then there was the rich old gentleman sitting in his wheelchair beside an open window as a slick chick walked by, displaying a comely figure.

"Quick, Jenkins," called the old gentleman to his valet. "Bring me my teeth, I want to whistle."

CRACKS OF DOOM

A school teacher telephoned the mother of one of her pupils to discuss the actions of the boy. "He swears terribly on the playground, and I just can't make him stop it," she complained.

"Jes' lak his pappy!" exclaimed the mother.

"And besides that, he pulls the girls' hair and slaps them and makes them cry, and he won't apologize."

"Jes' lak his pappy!" the mother reiterated.

"And besides that, he steals things from the other pupils, and then lies about it when he is accused."

"Jes' lak his pappy!" the mother repeated. "Lawdy! Ah's glad Ah didn't marry dat man!"

* * *

The poor stork—he's always getting blamed for a lot of things some other bird is responsible for.

* * *

PYROTECHNICS

Little Susie's hair cracked, as her mother was combing it.

"Why does it crack?" the child asked.

"Because it has electricity in it."

"Gee," ejaculated the modern little miss, "we're sure in the groove. I got electricity, Grandpa's got gas on his stomach, and Daddy's all lit . . ."

"Not another word, Susie!"

FERTILIZER BORATE

more economical

FOR AGRICULTURE

Authorities have recognized that the depletion of Boron in soil has been reflected in limited production and poor quality of numerous field and fruit crops.

Outstanding results have been obtained with the application of Borax in specific quantities, or as part of the regular fertilizer mix, improving the quality and increasing the production of alfalfa and other legumes, table beets, sugar beets, apples, etc.

The work and recommendations of the State Agricultural Stations and County Agents are steadily increasing the recognition of the need for Boron in agriculture.

Boron is a plant food element and is commonly obtained from Borax since the element does not occur in the pure form. Fertilizer Borate is a semi-refined product containing 93% Borax.

Fertilizer Borate was placed on the market by the makers of "20 Mule Team Borax" as a fertilizer grade product to save cost of refining and hence to supply Borax at the lowest cost.

Fertilizer Borate is packed in 100 lb. sacks. Address your inquiries to the nearest office.

PACIFIC COAST BORAX CO.
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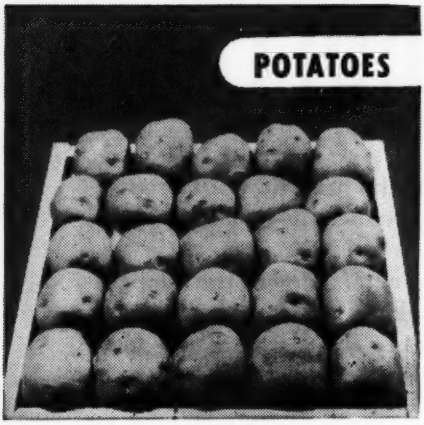
You can see V-C *in the crop*



When you use V-C Potato Fertilizer, you can see the results of V-C's better plantfoods in the crop. The plants grow vigorously, stand up more erect, are stockier and die more slowly in the fall. They produce bigger yields of chunky, uniform No. 1 potatoes of better color and more even maturity. These potatoes are more compact, thicker, shorter and wider, taking up less room by weight in the bin or bag. They grade out better due to less shrinkage in seconds and throw-outs with growth cracks and prongs. In shipping they are less susceptible to damage.

When you use V-C Small Grain Fertilizer, you can see the results of V-C's better plantfoods in your field of wheat, oats, rye or barley. Growth is quick and vigorous and plants stool out well. V-C doubles and trebles the number of tall, strong, well-developed stalks per plant—with each extra stalk an added producer of good grain at harvest time. You can depend on V-C Fertilizers to produce extra yields of low-cost, high-quality grain. V-C Fertilizers have been growing bigger yields of better quality crops since 1895. *You can see* V-C *in the crop!*

There is a V-C Fertilizer, containing V-C's better plantfoods, manufactured to meet the needs of every crop on every soil on every farm.

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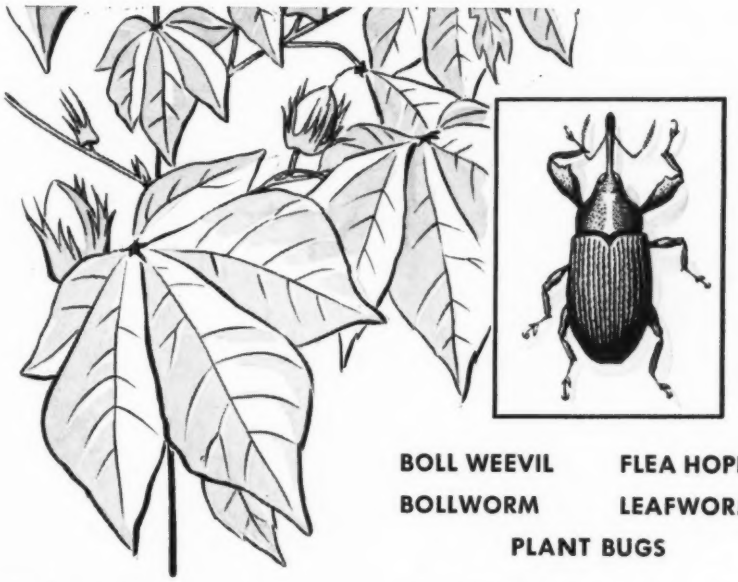

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TOXAPHENE-20
a dust to control cotton Boll Weevil and Bollworm, cotton Flea Hopper, cotton Leafworm, Thrips, Southern Green Stink Bug, Rapid Plant Bug and Tarnished Plant Bug.

Dosage: 10 lbs. per acre

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contains 40% sulphur to control Red Spider in addition to insects listed above.

Dosage: 10-15 lbs. per acre

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THE PLANT SPEAKS

A new four-reel series of 16 mm., sound, color films which may be booked independently or in any combination. They may be used to best advantage when shown at least one day apart and in the following sequence:

THE PLANT SPEAKS THRU DEFICIENCY SYMPTOMS pictures soil depletion, erosion, and deficiency symptoms on plants. (Running time 25 min. on 800-ft. reel.)

THE PLANT SPEAKS, SOIL TESTS TELL US WHY depicts taking soil samples on the farm and the interpretation of soil tests. (Running time 10 min. on 400-ft. reel.)

THE PLANT SPEAKS THRU TISSUE TESTS shows the value of tissue testing and the procedure for testing plant tissues in the field. (Running time 14 min. on 400-ft. reel.)

THE PLANT SPEAKS THRU LEAF ANALYSIS evaluates leaves in plant growth and leaf analysis in determining fertilizer needs. (Running time 18 min. on 800-ft. reel.)

We shall be pleased to loan these films to agricultural colleges, experiment stations, county agents, vocational teachers, responsible farm organizations, and members of the fertilizer trade.

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In the Clover (Northeast)
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Machine Placement of Fertilizer (West)
Ladino Clover Pastures (West)
Potash from Soil to Plant (West)
Potash Deficiency in Grapes and Prunes (West)
New Soils from Old (Midwest)
Potash Production in America (All)
Save That Soil (All)

Borax From Desert to Farm (All)

IMPORTANT

Requests should be made *well in advance* and should include information as to group before which the film is to be shown, date of exhibition (alternative dates if possible), and period of time of loan.

American Potash Institute
1155 Sixteenth Street
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